2008

Designing a nutritional packaging system for end stage renal disease patients on hemodialysis to maintain their diet and health

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by

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A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF FINE ARTS

Major: Graphic Design

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Iowa State University

Ames, Iowa

2008

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

First, I would like to dedicate this thesis to my father, Kun Duk Lee, who has survived from end stage renal failure on hemodialysis for 10 years. He has given me wonderful support and encouragement through this tough time. Most importantly, he has taught me how life is precious. Without his inspiration I would not be able to write this thesis, nor would I be able to raise the awareness of chronic kidney disease within the design community.

I would also like to express my gratitude to my committee members for their time and commitment. To my major professor, Roger Baer, who believed in my project from the beginning and has offered unlimited support, and to Deb Satterfield and Fred Malven, who always had great suggestions and contributions to the project. Thank you for everything you have done to make this thesis possible.

Lastly, I would like to extend my deepest thanks to my family, my colleagues, and my friends. Thank you for encouraging me to pursue my graduate education to further my career. Thank you for helping me through some of the toughest times in my life. Thank you for providing me with endless love and support. Without all of you I would not be where I am or who I am today. I wish all of you great success in your life in the future.

Thank you all.

ABSTRACT

End Stage renal disease; or ESRD is a kidney disease that requires a strict dietary regimen in order to limit the life-threatening effects of a poor diet. This dietary regimen requires careful regulation of 8 essential nutrients: calories, proteins, sodium, phosphorous, calcium, potassium, vitamins, and minerals. This strict diet creates a number of complications in patients' lives, including malnutrition, fatigue, other diseases, and death.

The purpose of this study was to develop an appropriate packaging system that provided nutritional information, was appetizing, and focused on the cognitive, affective, and emotional dietary needs of ESRD patients.

The design research for this study included the examination of packaging design, labeling systems, principles of effective packaging design and typography. In addition, this study researched the unique dietary and physical needs of ESRD patients.

The methodology includes case studies with three nutritional systems from the food industry and the development of an evaluation matrix that allows for an analysis of food packaging based on design principles and nutritional information.

CHAPTER 1: INTRODUCTION

Chronic kidney disease (CKD) is a condition which causes ongoing or permanent loss of kidney function. This disease is a growing health problem in the United States; it is a fairly common condition that affects many people. According to *National Kidney Foundation*, twenty-six million American adults are living with CKD (NFK, 2007). In the more advanced stages of the disease, CKD patients develop ESRD (End stage renal disease). There are an estimated 385,000 patients in the United States being treated for ESRD. The treatment for end stage renal disease requires that the patient be on dialysis or receive a kidney transplant to sustain life (CDCP, 2006).

Patients with end stage renal disease (ESRD) require continual care. They must learn to manage a complex treatment consisting of dietary restrictions, fluid limitations, medications and vascular access care–the site where blood will be removed and returned to the body during dialysis (NFK, 2007). These routines are very challenging to ESRD patients who are on hemodialysis. The elaborate personal care procedures required of these patients impact the quality of their everyday lives. Understanding what daily challenges confront patients with ESRD and how they influence the quality of their lives is important in both a humanitarian sense and a medical sense.

End stage renal disease (ESRD) patients face physiological, psychological and social stress, largely due to the ongoing hemodialysis treatments. In the physiological sense, ESRD patients need to receive hemodialysis regularly, and maintain a strict renal diet to control their condition. Despite the strict diet, the patient must find ways to obtain the proper nutrition necessary to sustain their health and delay the progression of the kidney

disease. Without sufficient dietary energy sources, patients are unable to maintain their health, which can lead to death.

Psychologically, the treatments affect changes in the patients' lifestyle, which are likely to increase fatigue, depression, and make them feel like outcasts from their social group. Depression, fatigue, and a sense of social isolation tend to reduce appetite and lead to malnutrition. A vicious circle develops. The main reason ESRD patients suffer from malnutrition is not a lack of knowledge about appropriate foods, but limited availability of the food choices.

Patients with End Stage Renal Disease (ESRD) on hemodialysis are required to follow strict renal diets to sustain their health. In their diets they are allowed to consume limited amounts of calories, proteins, sodium, fluids, phosphorous, calcium, potassium, vitamins, and minerals. If ESRD patients on hemodialysis exceed the limits of these nutritional elements, they are likely to face the complications explained earlier.

Problem

The problem is that even when ESRD patients are knowledgeable about their diets, they tend not to follow them. The struggle with inadequate time and nutritional information is so frustrating that the patient rejects the diet. This in turn is detrimental to the patient's health. The long list of forbidden foods from the dietician is difficult to follow, depressing, and inflexible. A shortage of available food choices in supermarkets makes even home cooking difficult. Food preparation may be so time consuming that a patient, who is already physically exhausted, often skips meals or eats whatever is available. Maintaining a proper diet is burdensome or impossible, but absolutely necessary. Diet becomes a constant

struggle that consumes their daily lives. When the consequences of improper diet are failing health or death, finding ways to control the diet becomes critical to an ESRD patient's life.

Purpose

Many of the stresses experienced by ERSD patients could be reduced by a dietary regulation system that would focus on what the patient can eat, rather than what they can't; as the forbidden food list tends to do. The purpose of this study, therefore, is to improve the current dietary regulation system by creating a nutritional packaging system that would:

- Create an appetizing and readable packaging system that emphasizes fresh appealing foods and does not resemble medical packaging.

- Develop a package design that clearly communicates not only product information but also the nutritional information badly needed by ESRD patients.

- Develop a consistent and accurate label design system with strong product differentiation that visually represents the nutritional facts printed in detail on the back of the package.

- Use design principles and research to create a package that communicates effectively and is visually pleasing.

Providing ESRD patients with convenient, flexible, and accessible package design with clear nutritional information on the label would help with many of the dietary difficulties of the disease. This is an important problem to solve because if ESRD patients

go beyond the limits of nutritional elements, they can face life threaten complications that can lead to other diseases or death.

CHAPTER 2: LITERATURE REVIEW

Kidney

Most people are born with two kidneys which are an essential for the human body to sustain life. The kidneys are bean shaped organs, approximately the size of fist, and located on either side of the spine in the lower middle of the back close to the rib cage (NIDDK, 2007). Each kidney weighs about a quarter pound and contains approximately one million nephrons or filtering units. The kidney is connected to the urinary bladder (Emedicine Health, 2007). Although kidneys are a small part of human body, they execute many vital functions to keep the body healthy, alive, and functioning properly.

Function of the Kidney

The kidneys perform several vital functions that serve to balance and control the human body. The main function of kidneys is filtering or removing waste and excess water from the blood. This also helps to maintain balance of fluids in the body (Davita, 2007). When we eat and drink, the body extracts the nutrients needed to sustain energy and repair the body. The unneeded parts of the foods and liquids consumed become wastes, circulating in the blood stream (NIDDK, 2007). The kidneys filter the blood and remove the wastes. If waste builds up in the blood, it can become toxic and damages the body.

Role of the Kidney

Kidneys also have an important regulatory role in maintaining the level of certain chemicals or minerals in the body and they produce the several important hormones. Too

much of some chemicals or minerals; such as salts and acids, sodium, phosphorus, calcium and potassium; can be harmful to the body (Davita, 2007).

The kidneys produce three important hormones that help to maintain bodily functions, Rennin, erythropoietin, and calcitrol. Rennin expands or contracts blood vessels to regulate blood pressure, erythropoietin sends signals to the bone marrow to make more red blood cells, and calcitriol simulates a form of vitamin D to regulate absorption of calcium and phosphorus from foods, which in turn maintains bones strength. (Emedicine Health, 2007). Without working kidneys the body cannot function properly to maintain the bones, muscles, brain and other organs.

Kidney Failures and Diseases

We have seen that kidneys function in many important ways to sustain the body. However, illness or injury can cause the kidneys to stop working. Therefore, waste builds up in the body and can damage other organs, such as the heart, brain and lungs, increasing the likelihood of serious illness or death (AAFP, 2003). The many causes of kidney failures are not completely understood, however, they can happen quickly or slowly.

Acute Renal Failure

Acute renal failure is caused by common illnesses, injuries, and obstruction. These factors lead to sudden decrease in the kidney faction. Illness causes kidney failure when symptoms, such as fever, vomiting and diarrhea can lead to dehydration which causes a decrease in the kidney function (Needham, 2005:1739). When the illness end the symptoms might not go away if acute renal failures is not treated properly. Injuries from accidents or

improper medication can reduce the blood supply to the kidney or decrease the flow of the urine (Needham, 2005:1740). The traumatized kidneys cause low blood pressure which decreases the flow of blood and may prevent urination. This, in turn, can lead to a dangerous build up of waste and toxins in the body. Physical entities such as a kidney stones or a tumors can cause obstruction of the outflow tracts of the kidneys (Needham, 2005:1741). Typically, the acute renal failure can be corrected by appropriate treatment; untreated, however, these incidents can lead to chronic kidney disease.

Chronic Kidney Disease (CKD)

Chronic kidney disease (CKD) is a condition in which the kidneys lose their ability to filter out excess wastes, minerals, and maintain appropriate fluid balance. Therefore, the harmful wastes can build up to cause the body to feel ill; appetite loss tends to accompany this feeling. Typically, the kidney does not fail abruptly; CKD is a progressive disease, and advancement of the disease is slow and incremental. The effects are often "silent" but "devastating," (NIDDK, 2007). Kidney failure tends to occur gradually, often unnoticed over a period of months or years. "People may not notice the symptoms until there is a significant loss of kidney function" (Davita, 2007).

It is customary to divide CKD into five stages, which are defined by varying levels of the severity. These stages are measured by glomerular filtration rate (GFR), which is a measurement of how effectively the kidneys filter wastes and fluid from the bloodstream (Davita, 2007). The *National Kidney Foundation* defines each stage by different degrees of impaired kidney function (Table 1).

Stage	Description	GFR Level
1	Kidney damage with normal or increased GFR	90 mL/min
2	Kidney damage with normal with mild decreased GFR	60-89 mL/min
3	Moderate decrease GFR	30-59 mL/min
4	Severe decrease GFR	15-29 mL/min
5	Kidney failure/ ESRD	Less than 15 mL/min

Table 1. Stages of Chronic Kidney Disease (CKD) (McClellan, 2005:422).

Fortunately, chronic kidney disease can be controlled in the early stage by slowing the progression of the disease and perhaps avoiding complete kidney failure. "With early diagnosis, it may be possible to slow, stop, or even reverse CKD, depending on the cause" (Davita, 2007). In some cases, however, the CKD cannot be controlled or reduce and the disease advances to the last stage of the disease, which is known as end stage renal Disease (ESRD).

End Stage Renal Disease

End stage renal disease (ESRD) is final stage of CKD, in which the kidney is no longer able to function at a level that will sustain life. Patients who develop ESRD need to undergo treatments such as hemodialysis, peritoneal dialysis, or kidney transplant to stay alive. "Without them, you will continue to accumulate toxins and excess fluid in your bloodstream causing your major organs to shut down, which can lead to death" (Davita, 2007). According to William McClellan, the Medical Director of Health Services Research

at the Georgia Medical Care Foundation, ESRD has multiple negative effects on the patient: anemia, renal bone disease, nutritional impairment, neuropathy, impaired quality of life and reduced life expectancy (McClellan, 2005:419). ESRD can cause serious health risks and consequences; it is fatal if the individual does not receive proper treatment.

Kidney Disease Treatments

The treatments of patients with chronic kidney disease can be challenging. Treatment depends on the type of kidney disease, the severity of kidney damage, and complications or developments of other diseases (Johnson and Levey, 2004:873). The individual with kidney disease needs appropriate treatments to slow down the progression of the kidney disease and decrease the risk of additional complications. Many kidney disease patients, especially ESRD patients, undergo intense treatments such as dialysis, and a strict diet or transplant to maintain their body and sustain life.

Dialysis

Dialysis is defined as "a method of removing toxic substances (impurities or wastes) from the blood when the kidneys are unable to do so" (NIM and NIH, 2007). Dialysis replaces the function and role of a healthy kidney. There are two types of dialysis: hemodialysis (Figure 1) and peritoneal dialysis (Figure 2).

Hemodialysis involves a dialysis machine which circulates blood through a filter to eliminate the waste and excess water. The dialysis machine returns the clean blood to the body and stabilizes the level of acids, chemicals, and minerals (Emedicinehealth, 2007).

The hemodialysis ritual is lengthy and repetitive; it is typically performed three times per week for three to four hours at a dialysis center (NIDDK, 2007).

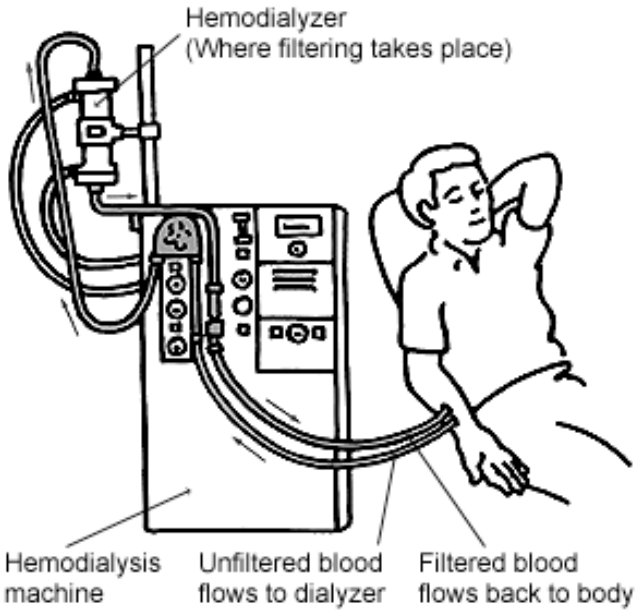

Figure 1. Hemodialysis. Accessed at www.niddk.nih.gov on November 10, 2007.

Peritoneal dialysis "utilizes the lining membrane (peritoneum) of the abdomen as a filter to clean blood and remove excess fluid" (Emedicinehealth, 2007). This means, the abdomen wall acts as filter system to cleanse the blood of wastes and the toxins. A dialysis fluid, called dialysate, is inserted into abdomen for few hours and then drained away (Davita, 2007). Patient can execute this routine manually, continuous ambulatory peritoneal dialysis (CAPD), four to five times a day to drain the fluid every three to four hours in any clean places. Patients can also use automated peritoneal dialysis (APD), which is an automated machine known as a cycler (Davita, 2007). This procedure takes place while the patient is asleep. The process takes over eight to ten hours and the machine exchanges the

fluid three to five times per night. Therefore, the patients are allowed to enjoy freedom during the day (Davita, 2007).

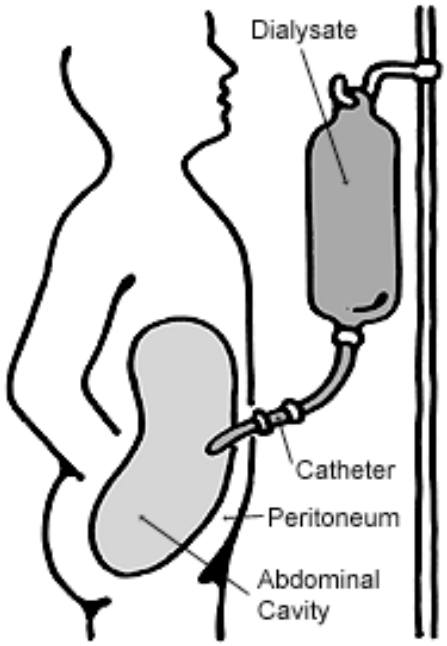

Figure 2. Peritoneal Dialysis. Accessed at www.niddk.nih.gov on November 10, 2007.

Kidney Transplantation

A kidney transplant is an operation to replace a failed kidney with a healthy kidney. The healthy kidney must be obtained from a living or non-living donor. According to the *National Kidney Foundation*, currently in the United States, over 95,000 patients are waiting for an organ transplant and every month least 4,000 new patients are added on the waiting list (NFK, 2008). A successful kidney transplant offers the patient greater freedom, increased energy, a less restricted diet and a better quality of life (NKF, 2008). The body, however, may reject the new kidney, because the immune systems in the body are programmed to protect the body by recognizing and attacking foreign objects. Therefore,

transplant patients have to follow special dietary guidelines and take anti-rejection medication the rest of their lives to suppress the immune defenses and sustain the new kidney (NKF, 2008).

Renal Diet and Nutrition Guidelines

A renal diet is extremely important for patients who are victims of kidney failure, who are on dialysis, or who are the recipient of transplantation. The renal diet can help control the waste and fluid build up in the blood to preserve their wellbeing. However, the dietary restrictions are very challenging for many patients. For example, Judith Curtis, kidney patient, talks about her experience with her dietitian. The dietitian handed out a long list of forbidden food and Judith decided to tuck her list in a drawer and avoid it instead of memorizing the list (Curtis, 3). Later, Judith learned to take the diet seriously because her health and wellbeing was declining. Finding herself at risk for other diseases and tired of being lectured every month by the dietician, Judith began to understand the importance of diet. Kidney patients need to control intake of eight important nutrients: calories, protein, sodium, phosphorous, calcium, potassium, vitamins and minerals. They also need to control their fluid intake to control weight and body swelling. These patients tend to suffer from malnutrition due to their poor intake of nutrients. Here are the descriptions of the importance of each nutrient below:

- Calories

  Calories are important for maintaining energy, a healthy body weight, and signaling the body that readily available calories have been expended and the body must begin to use protein as an energy source (NKF, 2006). In order to maintain body weight, patients can add fat to their diet which will also improve

flavor, increase moisture and add calories in their food (NKF, 2006). Also, carbohydrates (bread, cereals and vegetables) can provide fuel or energy for the body since they contain small amounts of protein (NKF, 2006).

- Protein

  Protein builds antibodies, muscles, and repairs tissues for the body. Protein is found in animal sources (beef, pork, chicken, eggs, milk) and plant sources (soybean, legumes, and nuts) (Davita, 2007). However, ESRD patients are told to limit the amount of protein in their diet to reduce protein waste buildup in the blood. Some of the foods that contain protein also have high potassium and phosphorus levels (Davita, 2007).

- Sodium

  Kidney disease patients need to maintain sodium carefully because they are often related to high blood pressure and fluid intake. Consuming salty foods, such as canned soups, seasonings, and chips, can increase thirst which can lead to drinking too much fluid (NKF, 2006).

- Fluid

  Fluids can be any food or beverage that takes a liquid form (soda, coffee, water, ice cream, soup, and gelatin). Consuming too much of these can cause “swelling or puffiness around the eyes, hands or feet, fluid weight gain, shortness of breath, increased blood pressure, and cause the heart to work harder than usual” (NKF, 2006).

- Phosphorus

  In many cases, neither weakened kidneys nor dialysis machines can remove adequate amounts of phosphorus from the blood. Therefore, phosphorous can easily build up in the blood and cause the patients to have itchy skin and loss of calcium in the bones (NKF, 2006). Loss of calcium leads to weakness and

fragile bones. Patients must avoid foods that contain large amounts of phosphorus, such as beans, nuts, dark color beverages, and dairy products (NKF, 2006).

- Calcium

  Calcium provides important minerals to build strong bones, however, many food with calcium also contain high level of phosphorus. If the levels of calcium and phosphorus are imbalanced, it can cause bone disease, calcification of arteries and important organs such as the heart (NKF, 2006).

- Potassium

  Potassium regulates nerves and assists muscles, including the heart, to function properly. "Too much or too little of potassium in the blood can be dangerous because that can cause cardiac arrest or death" (Stöppler and Lee, 2007). Potassium can be found in certain fruits and vegetables, such as oranges and tomatoes, and as well as in protein-rich foods (NKF, 2002).

- Vitamins and Minerals

  A variety of foods contain vitamins and minerals, however, some of them are harmful to kidney disease patients. For example, *Treasure of the East*, the herbal product, contains aristolochic acid, which is a powerful carcinogen and toxic to the kidneys. This chemical can cause serious kidney damage that lead to kidney failure and the risk of kidney cancer (FDA, 2001).

Quality of Life

Sadly, the majority of chronic kidney disease (CKD) patients are diagnosed at the final stage, end stage renal disease (ESRD), which requires dialysis or transplant to sustain life (William, Crane and Kring, 2007:610). Most of ESRD patients that receive

hemodialysis suffer from the physiological, psychological, and social stresses discussed earlier.

Physiological Stress

End stage renal disease (ESRD) patients on hemodialysis experiences many physiological stresses, such as impaired vision, malnutrition, and fatigue, due to the progression of the disease and the effects of the treatment.

1. Vision

   ESRD patients on hemodialysis for long periods of time experience changes in vision. According to Ryan Evans and Mitchell Rosner, Division of Nephrology, the patients can experience ocular abnormalities due to hemodialysis (Evans and Rosner, 2005:252). These visual impairments, include chronic eye disease, such as diabetic retinopathy and glaucoma and sometimes blurred vision (Tomazzoli, et al. 2000:403). The visual impairment of ESRD patients on hemodialysis are not caused only by hemodialysis, they are also caused by related issues such as diabetes, age, or dry eye. Stephen Fadem, nephrologists, states ESRD patients have been report visual perception changes when they start dialysis, however, these reports are rare (Fadem, 2005:12). The poor vision experienced by hemodialysis patients can take any of the forms of described below:

   - Anterior Ischemic Optic Neuropathy
     Anterior Ischemic Optic Neuropathy occurs in dialysis patients with predisposing condition, such as atherosclerosis, hypotension, hypertension

and anemia. These conditions can affect the optic nerve and cause blurred vision or loss of vision of one or both eyes (Fadem, 2005:12).

- Syncope

  Syncope is "the temporary loss of consciousness due to a sudden decline in blood flow to the brain" (NINDS, 2008). During dialysis, the blood supply to brain can be disrupted suddenly; the resulting drop in blood pressure can cause syncope symptoms. Syncope can blur patient's vision and involve light headache, weakness, nausea or vomiting. These symptoms are especially likely to occur among ESRD patients who are also diabetic (Fadem, 2005:12). Also, many of the diabetic ESRD patients develop retinal detachment resulting in blurred vision. These patients can be evaluated for laser therapy (Fadem, 2005:12).

- Macular Degeneration

  Macular degeneration is an "area on the retina that allows perception of color and fine detail however, if macular's cell lose function it may impair eyesight" (Fadem, 2005:13). Macular degeneration can cause a severe eye disorder and blurred vision (Fadem, 2005:13).

- Age Related

  Many elderly people/patients, over the age of sixty-five have eye problems, such as dry eye, vision loss, blindness, cataracts, and glaucoma. A common reason is their kidneys do not function properly due to illness, which can cause a risk of dehydration of different body part, such as the eyes (Stein, 2003:8).

2. Malnutrition

Patients with ESRD often suffer from malnutrition due to hemodialysis.

Malnutrition often results from "inadequate dietary quantity or quality caused by

unavailability or lack of appropriate food" (Dwyer and Kenler, 63). Therefore, ESRD patients experience uremic malnutrition symptoms, which are decreased tissue function and body weight that lead to anorexia, nausea, constipation and low levels of physical activity (William, Crane and Kring, 2007:611). One reason ESRD on hemodialysis tend to suffer from malnutrition is that the patients have difficulty shopping for or preparing food. This is a serious problem for ESRD patients who require a strict diet in order to ensure proper health. The problem is not that they are ignorant of appropriate nutrition; *The Journal of the American Dietetic Association* discovered ESRD patients have a great knowledge of their diets; however, they do not necessarily follow the prescribed diet (Durose, et al. 2004:39). The dietary limitations can be overwhelming and discouraging for some patients. Because of the factors just discussed, ESRD patients often do not or can not follow the proper diet, and, as a result, twenty to fifty percent of ESRD patients on hemodialysis are also found to suffer from malnutrition. Malnutrition can also lead to inflammation, infection, cardiac disease, hospitalization, and even mortality (Williams, Crane and Kring, 2007:611).

3. Fatigue

Fatigue is another side effect common to ESRD patients. "Fatigue is an unpleasant feeling of tiredness or exhaustion, which can hamper individuals' normal ability to function" (McCann and Boore, 2000:1132). Feelings of fatigue cause low levels of energy, motivation, and activity among these patients. Reduced activity leads to a decline in physical abilities, which can cause muscle weakness

and joint pain, sleep disturbance, anxiety, and depression (O'Sullivan and McCarthy, 2007:277). The negative effects of fatigue are commonly divided into the following three types of fatigue:

- Physical Fatigue

  Physical fatigue is a situation that is related to "physical discomforts caused by long-term hemodialysis and uremia" (Lee, et al. 2007:410). End stage renal disease (ESRD) patients experience physical fatigue such as exhaustion, bodily pain, sleep deprivation, and lack of physical energy (Lee, et al. 2007:410). Many hemodialysis patients rest or nap after the treatment because they feel either dizzy or worn out. A packaging system for ESRD patients would, therefore, reduce the time and energy needed to select and prepare meals. Therefore, the well design packaging system can help ESRD patients to access the food without cooking a meal.

- Affective Fatigue

  Affective fatigue is an experience related to the patient's "emotional state" (Lee, et al. 2007:410). Many patients feel that the treatment is boring, repetitive, and endless, which can cause a feeling of helplessness, entrapment, and inconvenience. They feel that they have lost control of their lives (Lee, et al. 2007:410). This suggests an attractive package design depicting appetizing meals to encourage food consumption.

- Cognitive Fatigue

  Decreased cognitive function among hemodialysis patients is caused by cognitive fatigue. Because of cognitive fatigue, many ESRD patients on hemodialysis separate themselves to cope with the fatigue (Lee, et al. 2007:411). According to one patient, "Often I find myself speaking in a strange way. People don't understand what I say. And I can't remember what I said or did. I just can't concentrate" (Lee, et al. 2007:411). When the

patients are tired it is hard to focus and converse intelligently with others. In terms of packaging design this indicates that the design must communicate clearly so the patients do not need to search for vital nutrient information.

Psychological and Social Stress

Due to constant physiological stress, many ESRD patients living on hemodialysis suffer from psychological and social stress, such as depression, anxiety and fear (Mollaoglu, 2004:544). ESRD patients lives is depend on hemodialysis treatment with a strict diet, which the patients cannot fully control. These major lifestyle changes can create a sense of insecurity, limitation, and restriction. One patient explained, " I was always extremely out going, very independent person at that time. Your life is somewhat restricted because you have to save those hours that you have to go to dialysis. Your fluids are limited, can't drink the drinks you like to drink. You have to watch everything" (Al-Arabi, 2006:288).

Financial instability can also create psychological and social stress. Most ESRD patients earn an income of less than $6000 per year or are unemployed because they are often sick and therefore lose time from work (Dwyer and Kenler, 64). Many ESRD patients have fixed incomes; Medicare covers care such as dialysis, but other medical expenses are not covered. Therefore, ESRD patients do not have "enough resources to buy the food required by their strict diets, their prescribed drugs, and socialize with their peers" (Dwyer and Kenler, 64). These stressors can affect their self-esteem, and create feelings of dependence, helplessness, loss sense of freedom, and role functions among families and among friends (Al-Arabi, 2006:287).

On the other hand, end stage renal disease (ESRD) patients can experience less anxiety and depression by participating in community support activities. Social support can be defined as "the presence or availability of people to rely on and who facilitate a feeling of being cared about, loved, and valued" (Williams, Crane and Kring, 2007:612). Social support can create positive experiences that allow ESRD patients to enjoy their life a little more. When friends, family and the community supported ESRD patients on hemodialysis, "they experienced less anxiety and depression and were more likely to participate in social and community activities" (Williams, Crane and Kring, 2007:612). Social support can help ESRD patients to be more active, think positive about their life, themselves, and the disease. It may also motivate them to help other ESRD patients to overcome their fear.

ESRD patients on hemodialysis are affected by chronic kidney disease physiologically, psychologically, and socially. Many of these factors are closely associated with insufficient availability of the foods required by a strict renal diet. Maintaining this strict diet can be challenging; it can even affect relationships with families and friends.

Discussion about Diet and Kidney Disease

Kidneys are vital in keeping the body healthy, alive, and functioning properly. Kidneys also help to maintain the balance of chemicals, minerals, and fluids. They function to clean the blood, and remove the wastes from the body. Therefore it is necessary to use other means to maintain an appropriate balance of these chemicals, minerals and fluids. ESRD patients, whose kidney function has reduced to the point that so they need dialysis, require a strict nutritional diet in order to compensate for the lack of kidney function. This diet requires eight essential nutrients: calories, protein, calcium, phosphorus, potassium, sodium,

vitamins, and minerals. They need appropriate amounts of these nutrients to reduce complications such as malnutrition, fatigue, other diseases and death. Inability to find and identify the proper foods complicates this problem. An improved packaging design could assist ESRD patients on hemodialysis to manage a proper diet more easily. Using good package design strategies, the graphic designer can create a cohesive numbering and labeling system that will help ESRD patients find the right foods. Better packaging would enable these patients to eat better and maintain their health which would slow the progression of their kidney disease. This data suggests that the graphic packaging designer has several areas for intervention. Declining visual acuity in ESRD patients suggests that legible, readable type, and color combinations are necessary. The factor of fatigue suggests several possibilities for packaging improvements.

Defining Packaging Design

Contemporary packaging design is often focused on emerging aspects of culture. The designs are constantly changing in an attempt to attract and trigger the minds of the consumer. According to Allen Rabinowitz, creative director, the average consumer spends "less than a second scanning shelves and will make a decision on whether or not to purchase any give product" (Rabinowitz, 2004). This means that packaging design should target a particular audience in order to engage their interest, attention, and awareness. Packaging design should communicate with consumer very quickly. Consumers must be able to recognize the product quickly, differentiate it from competitors, and understand the product.

Packaging Design: What is it?

Packaging design is a difficult term to define: visual communication, marketing, aesthetics, and culture are all aspect of packaging design. There have been many attempts to define term:

Walter Soroka, instructor at the Institute of Packaging Professionals (IoPP), defines packaging as

> "A coordinated system of preparing goods for transport, distribution, storage, retain, and use" (Soroka, 3).

Marianne Rosner Klimchuk and Sandra Krasovec, assistant professors at the Fashion Institute of Technology, define the difference between the term packaging and package.

> *Packaging* is "the act of wrapping or covering an item or group of items," and *package* refers to "the physical object itself–the carton, container, or bundle" (Klimchuk and Krasovec, 34).

International Trade Centre, Packaging Design: A practitioner's manual, defines packaging design as

> "A systematic approach to achieving these two goals: safe arrivals and effective promotion of the product" (International Trade Centre, 1).

Allen Rabinowitz, creative director, simply defines packaging design as

> "The discipline of creating the container, graphics and visible outer presence of a product a consumer buys at retail or might receive in the mail" (Rabinowitz, 2003).

Packaging design is a medium that communicates product brand, function, information, and characteristics; it should create a memorable experience with the product. Packaging is not just a container or materials such as paper, metal, glass, or plastic. Good packaging design goes beyond the basic functions of the package; protection, distribution, transportation, and storage. It endows the product with unique attributes, a personality, and

places it within the culture. In addition, packaging design helps the consumers to make their decisions efficiently by differentiating the product from those of the competitors in a hectic retail environment.

Packaging Features and Characteristics

In the functional sense, packaging design facilitates product protection, distribution, preservation, and storage. However, packaging design also provides the identity, form, structure, color, imagery, typography, and design elements necessary to distinguish the product. Packaging serves as not only the functional requirements of packaging but also "as the aesthetic means of communicating to people from all different backgrounds, interests, and experiences" (Klimchuk and Krasove, 33). Understanding different "social and culture variations, nonbiolgical human behaviors, and culture preferences and distinctions" (Klimchuk and Krasove, 33) of the target audience can help guide the use of visual elements in the design of effective communications.

The Role of Packaging Design

In early civilization, packaging design was created to serve a utilitarian purpose. Packaging functioned to contain and protect the product. As civilization advanced, growth in economics, technology, distribution and consumption of goods, made the visual communication aspects of packaging design more important (Klimchuk and Krasove, 2).

Communication Tool

According to Klimchuk and Krasovec, packaging design began as pictorial, symbolic, and textual representation used to identify the product visually. These

representations became the foundation of visual communication. For example, German papermakers such as Andrea Bernhart, in the mid-1500s, produced a product watermarked by a decorative printed design (Klimchuk and Krasovec, 4). Over time, packaging design developed into a new phenomenon used to market and distributes consumer goods. This new phenomenon became sophisticated, complex, and evolved with the "idea that the visual experience provided by the package was critical component to sales" (Klimchuk and Krasovec, 4).

Marketing Mix and Sales Tool

Packaging design, in the modern age, has become one of the most powerful tools in the marketing.

> "The consumer is a skeptical listener and more elusive than ever, resulting in increased pressure on the communications capabilities of marketers. In the attempt to reach and persuade, one marking communication tool that continues to grow in importance is the product package" (Underwood and Ozanne, 1998:208).

Packaging has become one of the most important factors in the purchase decision at the point of sale; it influences impulse buying, and the selling process.

Packaging design increases sales by acting as the "sales man on the shelf" at the point of sale (Silayoi and Speece, 2004:607). This is critical in packaging design because the packaging becomes a primary vehicle for communicating important messages such as brand identity, product name and description, or nutritional and label information. Brand identity communicates "positive images to the consumer to trust the product, recognition to enhance familiarity and provide information of the product" (Meyers and Lubliner, 10). The product name and description identifies the brand of product on package. For example,

the logo of the brand can be any one of a number of forms such as typographic, symbolic or abstract, to create a relationship between brand and the product.

In packaging design, nutritional or label information needs to communicate clearly and effectively to convey key messages about the contents of the package.

> "Nutritional information and health claims were found to have independent effects on consumers' beliefs about the products' nutritional content" (Underwood and Ozanne, 1998:209).

If the package does not clearly convey essential messages and catch the consumer's attention, the consumer may ignore the product and move on to another brand. It is essential that packaging design be clear and provide specific information to avoid confusion and differentiate the product from its competitors.

Packaging also communicates "emotional values" (Vazquez, Bruce and Studd, 2003:603). The familiar package contributes to product loyalty. Purchasers begin to develop sense of ownership, identity, and belonging based on their product choices. In buying the product, the consumer becomes part of a unique group, owners of the product; packaging contributes this feeling and provides sense of satisfaction as soon as the customer touches the product. Packaging encourages consumers to build a relationship with the brand. For instance, the Jones Soda, Beverage Company, allows consumer to personalize the label by submitting his or her own photos. The consumer might want to customize the label for special occasion such as weddings, graduation parties, and promotions (www.myjones.com, 2008). The packaging design of the Jones Soda reflects the uniqueness and individuality of its product and its consumers (Klimchuk and Krasovec, 49). Packaging design became the means by which the product contents connect visually with the consumer and communicate the product's personality or function.

Product Differentiation

Packaging design plays a big role in helping consumers distinguish one product from another. The ability to attract attention visually is a vital component in packaging design because the consumer must notice the packaged product before they make a decision to buy it. Therefore, visual and information elements, such as color, typography, image, structure, and label, applied to packaging design become essential in the differentiation process. For instance, POM Wonderful's, pomegranate juice, has a unique hourglass shaped bottle to catch consumers eye. "The thing most noticeable about the POM, besides the hourglass-shaped bottle, was the fact it may have been labeled mango flavored, but it surely wasn't mango-colored" (Marvo, 2004). Packaging design's primary role is to make the package to stand out and engage consumers "through imagery, color, language, shape, format, or even the tactile quality of the packaging's materials" (Calver, 48).

Lifestyle and Behavior Pattern

The development of packaging technology has become a part of people's lives. According to Olga Ampuero and Natalia Vila, researchers from the University of Valencia,

> "Packaging lives in the home and potentially becomes an intimate part of the consumer's life constituting a type of lived experience between the consumer and the brand" (Ampuero and Vila, 2006:102).

For instance, Apple Ipod comes with a high quality black box that has elegant and delicate graphics. Packaging presents

> "Detail and nuance and texture and a sense of how users actually feel, what makes them smile, what makes the experience worthy and positive and sensual instead of necessary and drab" (Morford, 2003).

The Apple Ipod packaging is distinguished by simplicity, aesthetic appeal, clean straightforward imagery, and shapes with delicate textures. The packaging might be tossed away, however, packaging derives from the current trends in products and consumer behavior. Packaging design is a part of material society that uncovers different cultures, values, and beliefs. People see themselves and play out their lives through the design elements on the packaging.

The Function of Packaging Design

The basic function served by packaging differs depending on the different characteristic and intent of the packaging. Packaging's main functions are containment, protection, convenience, and communication (Robertson, 3). These functions allow packaging to build brand identity and standardize distribution on a large scale.

Containment

The containment function of packaging is to accommodate the produce with regard to physical features like size, shape, and weight, and protect it from the distribution environment. In the distribution environment, products are constantly moving from place to another. Many manufactured goods cannot be moved from one place to another unless the product is contained in a package. Milk, for example, cannot be distributed without a workable container. Imagine how difficult it would be to buy or sell milk without the convenience of a container. Without containment, product might also be lost or exposed to natural hazards such as insects, climate, and deterioration.

Protection

The protection function of packaging usually refers to protection of the contents from physical damage by natural causes, such as dust, water, and toxic contaminants. For instance, "oxygen in the air hastens both the chemical breakdown and microbial spoilage of many foods. To help preserve foods longer, scientists have developed ways to help overcome the effects of oxygen (United States Department of Agriculture, 2002). Therefore, meat packaging uses vacuum packaging to protect the meat from microorganisms and preserve its freshness.

Convenience

The developments of technology, innovation, and industrialization have changed our lifestyle; and packaging has changed with us. According to Gordon Robertson, professor at the University of Queensland, a number of households are now single person households, many people delay having children or getting married, and more women are active in workforce than before (Robertson, 4). Because of these changes, consumers place a high demand on convenience for a variety of products, such as single serving on-the-go meals, travel kits, or cleaning kits such as Tide to Go stain remover. Consumers would rather spend more time on leisure than working in the home. Packaging also allows the distributor to allocate the product easily and quickly. Therefore, packaging plays "an important role of in meeting the high demand of consumers for convenience" (Robertson, 4).

Communication

Packaging design is a creative tool that reaches out and communicates with consumers. Packaging catches the consumer's attention and delivers its message through physical and visual elements such as color, shape, imagery, and typography. According to Klimchuk and Krasovec, the combinations of physical and visual elements not only attract consumers, but they also convey "emotional, cultural, social, psychological, and informational cues" to them (Klimchuk and Krasovec, 34). Packaging design facilitates identification and differentiation of the product, thus helping the consumer make purchase decisions, and giving them information about how to use the product. Without these qualities, all packaging will look similar and the consumer would be confused, frustrated, aggravated, and discouraged. Packaging design provides the consumers with clear and specific information that enables them to identify, use, and enjoy the product.

Basic and Packaging Design Principles

A good package design involves the application of fundamental design principles to serve a specific design purpose. The package designer must be familiar with the basic principles of design, the principles of packaging design, and the use of typography. The designer uses this knowledge base to produce meaningful visual communications. "Knowledge of the fundamental principles of two-dimensional design is an essential component to any visual problem-solving assignment" (Klimchuk and Krasovec, 79).

The basic design principles are guidelines that help the designer manipulate the design elements: line, size, color, texture, form and space to create a visual composition. Understanding the relationships between the elements and principles of design enables the

packaging designer to foresee and direct the communicative impact of the overall visual communication. According to Klimchuk and Krasovec, the basic design principles help the packaging designer "understand what makes one packaging design layout work while another seems unresolved" (Klimchuk and Krasovec, 80).

The design principles are also invaluable to package design. Psychology indicates that the placement of visual elements on a package is significant because the packaging design elements help the consumer to recall, recognize, and distinguish the product (Silayoi and Speece, 2007:1499).

Typography

Typography provides visual and verbal communication to help the consumer identify the product and read the content easily. Typography has its own visual elements, including size, x-height, typeface, weight, and hierarchy. It has the power to draw attention to the brand name and add personality or character to the message. In addition to its design potential, typography often requires the designer to consider functional qualities such legibility and readability. Without legibility and readability, the package might fail to accomplish some of its informational purposes.

Type Size

Text uses different sizes, measurements and levels of contrast to communicate visually (Figure 3). Typefaces are measured in "points in the United States and measured in millimeters in the rest of the world" (White, 33). Text sizes are range from 6 to 72 points depending on the typeface (Figure 3).

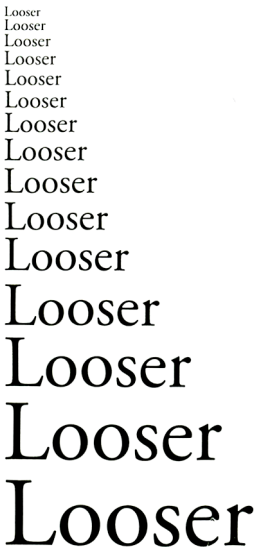

Figure 3. The Variable Type Sizes (Felici, 38).

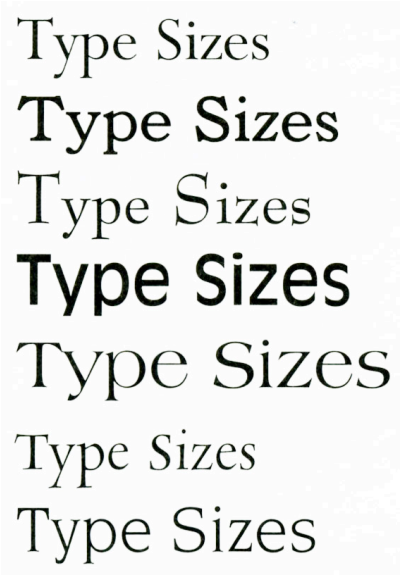

Figure 4. The Same Point Sizes with Different X-heights (Felici, 129).

Small text serves as information and does not function as a primary attractor. Large text will attract more attention and direct the reader's eye to other points of interest. For instance, if a shopper was looking for a single serving frozen food, and noticed the package below (Figure 5) he or she would first notice the product name in large text and then read

the small text to find more about the product. Typographic hierarchy at its most fundamental level is based on large to small.

Figure 5. Weight Watchers: Smart Ones Single Serving Frozen Food
Took Image from West Hyvee in Ames, Iowa on December 12, 2007.

X-height

The Readability of a font and legibility of text are affected by the x-height of the type font (Figure 4). According to Alex White, art director and consultant, "x-height is not a unit of measurement, but a distance within the overall size of the type" (White, 35). This means that the distance from the baseline to the median line, which is the top of the lowercase, is the x-height (Figure 6). Therefore, type sizes that have the same point size often appear different in size because the lowercase letter forms have different x-heights.

Figure 6. The Variable Distance of X-height (White, 34).

Typeface

A typeface is a group of letters, numbers, symbols, and punctuation marks that are designed with the same formal and proportional properties. They are the "parts of a coordinated outfit. Felici has said, "A typeface is an alphabet with a certain design" (Felici, 29). Every typeface is designed with its own distinctive characteristics, and there are many typefaces. The basic typeface classifications are serif and sans serif.

Serif fonts have short curved strokes at the ends the main strokes in the letterform (Figure 7). Serifs allow the eye and brain to differentiate individual characters from each other (Felici, 34). Serifs increase word recognition and lead the eye horizontally along the line of text providing a sense of flow from one character the next (Mitchell and Wightman, 65). The rhythm of Serif typefaces enables people to recognize the text easier and read faster. Serif has became the preferred type classification because they are more legible and readable in some contexts (Felici, 34).

Figure 7. Times New Roman Font (Top) and Arial Font (Bottom).

On the other hand, Sans serif type is simpler and has no extensions at the ends of the main strokes of the letterforms such as we find in the Serif typefaces (Figure 7). Sans Serif is often used when white or light type is used over a dark background, because the uniformally wide strokes provide better contrast with the background. Sans serifs typefaces are popular for use online. According to Suzanne Watzman, Watzman Information Design, sans serif is easier to read on screen because it prevents visual chaos. However, the actual on screen appearance depends on the resolution and size of the monitor (Watzman, 270). Legibility and readability of both serif and sans serif can be improved with proper text space or leading, size, style and color choice.

Weight

Another element in typographic hierarchy is the weight of the type. Weight is the "thickness of strokes in the letterform", which are light, bold, and italics (Figure 8) (Mitchell and Wightman, 434). A lightweight typeface has thin strokes that contain finer lines. They express elegance, delicateness, and subtleness. On the other hand, a bold weight typeface, which contains thick strokes, expresses loudness or strength. Used correctly, bolder typefaces increase contrast by helping the readers to identify titles or sub headings

quickly. Italic typefaces have vertical strokes that are slopped or curved. They emphasize or highlight specific points within the text, such as quotes or journal titles.

Using different weights of type can create useful contrasts and clarity by differentiating different areas of text. However, using too much contrast, light and dark or thin and thick, can create unpleasant reading experience to the readers.

Figure 8. Type Weight Variant (Felici, 41).

Typographic Hierarchy

The package designer uses size, x-height, font choice, and weight to organize visual material and create information hierarchy so that it will be read in the "order of the importance," (Klimchuk and Krasovec 2006:93). Typographic hierarchy should reflect the importance of the information that is presented on the package. Consumers will then read

the most important information on the package at a quick glance, distinguishing the brand and product immediately, before moving on to the details.

Legibility and Readability

Legibility and readability are essential if typography is to deliver the message and communicate clearly and effectively with the reader. Legibility and readability are often used interchangeably, but they are not the same thing (Felici, 104).

Legibility refers to a reader's ability to recognize the letterforms, because of the design of the font, "where the reader acknowledges the word as whole not by one letter at a time" (Felici, 104). Legibility enables the reader to identify, detect, and interpret the text easily.

The word readability refers to the "facility and comfort with which text can be comprehended" (Felici, 104). This means that if the text has great readability, then it will tend to attract and hold the reader's attention and provide a better quality reading experience. For example, many people suffer from vision change due to aging or from some other medical condition such as diabetes, especially between age forty and fifty (Nini, 2006). Therefore, understanding the readers' unique needs should influence the packaging design of products related to specific audiences. If the intended reader, for example, is likely to have reduced visual acuity (like many ESRD patients), then the designer must take that into consideration and specify text that will be sufficiently legible and put the text together in readable arrangements and configurations to ease their comprehension.

Careful use of typography enables the packaging design to communicate with the consumer effectively. Consumers are then better able to access, read and understand the information about the product.

Color

Color is a vital part of human life; it enriches our experiences and our communications. Color communicates at several levels of visual experience; emotional, symbolic, and visual; but it may communicate differently to specific demographics such as ethnic groups, age groups, and genders. Color has the potential to add impact to package design, but it must be used carefully.

Color and Light

Color is a visual language; it is a way that we perceive light which in fact is "composed with many colors such as red, orange, yellow, green, blue, and violet. Objects absorb certain wavelengths, perceived as color, and reflect others back to our eyes" (Pentak and Roth, 2). This means that we see the object reflecting the light as having color. Therefore, we see reflected or absorbed light as a colored object because the certain wavelengths of the light rebound from a surface which actually does not itself emit any light (Klimchuk and Krasovec, 106). For example, we see a red box as red because the box absorbed all of the light rays except the red rays, therefore the red rays were reflected back to the eyes. "Black objects absorb all of the light rays, reflecting none back to our eyes; white objects absorb no rays, reflecting all of them back to our eyes" (Carter, 2).

Emotional and Symbolical

Color affects people in different ways, which has been associated with mood or connotation. Color creates a mental association that determines each individual's perception of an object or its surroundings, even people with same background, culture and social group (Klimchuk and Krasovec, 106). Experiences with color differ from person to person because over the course of a lifetime each individual has had different experiences with color. For example, red color can represent love, passion, excitement, and fire. Red also can be a sign of danger or emergency. However, in packaging design, red is often used as an indication of intense flavor or fruitiness of product, such as in hot sauce or cranberry juice. Orange colors are associated with warm and cheerfulness. Orange colors communicate the vibrant and energy of the product, such as on the Wheaties cereal box. Yellow colors may provide sense of warmth, energy, and playfulness. Yellow colors can communicate flavors, such as a lemon or butter, or, as in Wheat Thins, to show wholesomeness. Green colors symbolize youth, life, and freshness. They are pleasing, relaxing and calming to the eyes. Green colors can also represent flavors like mint, as in Thin Mint, Girl Scout Cookies, or sour, apple, and lime. Blue colors symbolize truth, authority, and wisdom. In packaging design, blue can communicate confidence, stability, and security such as in products like Carb Smart or Swiss Miss hot coco. Purple symbolizes sophistication, royalty, luxury, and wisdom. Products such as Juicy Juice or Post Raisin Bran cereals signify mind, body, and berry flavors. The color black, in packaging design, helps to enhance other colors and represent sturdiness, reliability, and elegance, such as in Breyers ice cream. White colors communicate cleanliness, freshness and purity, such as we see on dairy products (Klimchuk and Krasovec, 112).

Color and Brand Identity

Color provides consumers with the means to define a brand visually. In packaging design, a brand connection is critical because a color becomes part of the brand over time. Therefore, when consumer sees the color of the product, they immediately associate it with the brand (Calver, 146). For instance, Kodak, a company known for photography, brands itself with red and yellow. They use distinct color palette to differentiate the Kodak brand from other products such as Fuji Film. By simplifying their colors, the brand stands out on the shelf which encourages consumers to approach and react to brand each in their own way.

Color and Product Differentiation

Color is used on packaging design to create attractive packaging, and generate the product's personality, attributes, and character sometimes preferred to as "the brand." Color draws the consumer's attention and serves to differentiate the product from others. In packaging design color is particularly influential because consumers are more likely to identify the color of a package or product before any other visual feature (Klimchuk and Krasovec, 107). Packaging should not only stand out beside the competitors, but different versions of the same brand product must be differentiated from one another. Color can be used as color-coding to differentiate product varieties and flavors. For example, Lean Cuisine, a frozen single serving microwavable meal, provides six different color-coding for their products to indicate the categories of foods (Figure 9). The yellow color indicates *One Dish Favorites*, which are simple, one-dish meals like ravioli. The green color indicates *Café Classics*, which are contemporary and inspired by restaurant meals like sesame

chicken. The red color indicates *Comfort Classic* that illustrates home-style American favorites like herb roasted chicken and meatloaf. The light blue color indicates *Spa Cuisine Classics*, which is inspired by whole grain goodness with great balance between taste and nutrition. The orange color indicates *Casual Eating*, which are perfect for laid back evening meals such as Panini turkey sandwich. The brown color indicates *Dinner Time Select*, which provides a large portion to satisfy the hunger (Lean Cuisine, 2007). Lean Cuisine demonstrates the use of color and image to give each family of products a distinctive personality or identity. The consistent use of a color on Lean Cuisine packaging assists consumers in differentiating the product quickly and easily.

Figure 9. Lean Cuisine Single Serving Frozen Food
Image from West Hyvee in Ames, Iowa on December 12, 2007.

Color and Product Selection

Color can serve to distinguish individual products within a branded identity system. Product selection provides a wide range of product variations so that consumers can find the product they need or like (Calver, 148). The consistent use of color schemes in

packaging design can enhance the product recognition and brand identity. For example, Selfridges Food Hall uses dramatic and surprising colors to unite the range of food products they produce (Figure 10). The striking color contrast helps the eye to distinguish varieties of product and the consistent base color and contrast level differentiates the Selfridges product line from the competitors (Calver, 148).

Figure 10. Selfridges Food Hall Packaging (Calver, 149).

Packaging Structure

In packaging design, a distinctive package structure means instant recognition of the brand identity. The assortment of package shapes and sizes provide, the consumer and the

retailer, with a wide array of functional features such as conveniences, product protection, storage, store display, and in home use (Meyers and Lubliner, 2). Shape plays a special role in packaging design. “A distinctive package shape provides a good opportunity to reinforce the brand image for the product” (International Trade Centre, 71). The shape of packaging indicates different types of packages that can be easily recognized without the label, such as a toilet bowl cleaner, a sparkling water, and an alcohol bottle (Figure 11) (Meyers and Lubliner, 4).

Figure 11. Different Shape of Packaging (Meyers and Lubliner, 4).

Moreover, the shape of the packaging can be used as the main branding element. The most famous example would be the Coca-Cola bottle (Figure 12). The Coca-Cola bottle was designed in 1915 and it is known worldwide as one of the most recognizable packaging designs (International Trade Centre, 71).

Figure 12. The Shape of Coca-Cola Bottle (Calver, 122).

Packaging Size

Different sized packaging helps consumers understand the volume of the product. Intuitively, the large package contains more product than the smaller package (Figure 13). According to Silayoi and Speece, the large size communicates to consumers who are looking for a good deal (Silayoi and Speece, 2004:612). For example, at the Sam's Club, a wholesaler retail store, the consumers can find large items at low prices such as a 64 ounces jar of Duke's Mayonnaise. This item will be the right size and represent a great value for the large household, but maybe not for the small household. For the small household, the large packaging means waste, because they never manage to use all of the product before the expiration date (Silayoi and Speece, 2004:619). Therefore they choose to purchase smaller product such as 18 ounces of Duke's Mayonnaise.

Figure 13. Duke's Mayonnaise 18 oz and Duke's Mayonnaise 64 oz.
Accessed on April 3, 2008 at www.samsclub.com.

Image

Imagery can create a strong visual impression to heighten the product's consumer appeal. Images can be simple, complex, or subtle. The visual impression may be immediate or it may require that the consumers to take a moment to engage with the product before they understand the concept or the meaning. Imagery, such as illustrations, photographs, and characters, can communicate through a visual dialect and provide visual stimuli (Klimchuk and Krasovec, 120). Therefore, vivid imagery enhances comprehension of message on packaging by accessing the consumer's previous learned associations with the imagery. (Underwood, Klein, and Burke, 2001:406). Proper use of imagery is a powerful tool in effective packaging design. It makes the package more desirable and strengthens visual communication.

Illustration

Illustration offers variety of styles that are useful in packaging design; each style communicates a distinctive message to the consumer. Styles of illustration range from simple line drawings to elaborate paintings each of which may be used to convey something about the product's character and distinguish it from competitors (Klimchuk and Krasovec, 123). According to Giles Calver, co-founder, design strategist and Managing Director of Lippa Pearce Design, illustration has two common but quite different connotations, traditional and modern (Calver, 142). Illustration can be seen as traditional or outdated, because illustration was the imagery of the past. Calver also suggests that illustration can be perceived as modern because illustration can demonstrate "modern, funky, natural, fashion-oriented and humorous" qualities that the photograph cannot deliver (Calver, 144). As examples of these two illustrative connotations, we might compare Classico pasta sauce to Ecor organic foods. Classico is a premium Italian pasta sauce. Its classic Italian recipes are inspired by regional traditions and the illustration emphasizes the homemade authentic quality of the Classico sauces (Figure 14). In contrast, Ecor, organic food company from England, uses bright, adorable, and whimsical illustrations to feature individual products (Figure 15).

Figure 14. Classico Italian Premium Pasta Sauce Accessed on April 3, 2008 at www.classico.com.

Figure 15. Ecor's Cereal Boxes (Calver, 2004:75).

Photograph

Unlike illustration, a photograph used in the package design will generate a sense of authenticity which is extends to the product. “The photography on package suggests fidelity and truth, whereas illustration tends to be more individualistic” (Roth, 32). The photograph is used on packaging to help the consumer to differentiate the product from a competitor, or from another product within its own brand. Photography may be used in a variety of styles. The designer must decide whether or not to crop the picture and also what kind of color to use. Color selections may include full color, black and white, one color, duotones, tints and screens (Klimchuk and Krasovec, 123). Food packaging, for instance, may use many photographic images to show their delicious product to tempt the consumer visually (Figure 16). Photographs of food act on the viewer’s natural food recognition sensibilities, to get the consumer’s attention and stimulate appetite.

Figure 16. Waitrose Fruit Juice Package with Different Photographs of Fruits (Calver, 2004:201).

Packaging Characters

Many packaging designs use characters, such as Tony the Tiger or the Quaker Oats Man, to give the brand a personality. Creating a character for the brand or product can be challenging, because the character can be loveable or hateful (Figure 17). For example, the Pillsbury Doughboy, also know as Poppin' Fresh, is made out of dough with a little chef's hat; he wears a white neckerchief and has two blue eyes. When you poke his stomach, the doughboy makes a giggling sound. According to General Mills, three years after his debut in 1965 the Doughboy had 87 percent recognition among consumers and he received 200 fan letters a week with 1,500 requests of autographed photos (General Mills, 2008). The Pillsbury Doughboy has a soft, warm, and adorable personality that relates well to the brand and product character. The Doughboy transmits a public image of a product that consumers like and trust.

Figure 17. Different Characters from Variety Brands (Klimchuk and Krasovec, 129).

Labeling

Labeling is another important aspect in packaging design and is a critical element for ESRD patients. Today, many people are concerned with the health and safety of the

products they purchase. Labeling on packaging designs does more than just represent brand identity, personality, and essential attributes of the product. Labels provide important information about the product such as serving size, calories, ingredients, instructions for use, place of origin, and weight.

Labeling on packages can influence the purchase decision, by either informational or aesthetic means. Informational labeling provides information about the product such as nutritional facts on the food packaging. According to the Institute of Grocery Distribution, in the United Kingdom, consumers read the product information on food labels up to sixty-one percent of the time, which has increased thirteen percent since year 2000 (Silayoi and Speece, 2004:609). Kashi, a natural food company, provides the quick and in-depth nutritional fact label on the front and back of the package (Figure 18). The consumers can understand, identify and recognize the product. The nutritional fact label, however, can be hard to read and comprehend, therefore, the Food and Drug Administration in the United States provides online guidelines to teach consumers how to read and understand the nutritional fact labels on the food packaging (Figure 19) (the United States of Food and Drug Administration, 2004).

On the other hand, the current consumers demands trendiness and convenience. They are impulsive and often too impatient to read all the information on the package (Silayoi and Speece, 2004:609). Therefore, they want the label to be attractive with simple, clean and clear messages that can be understood quickly (Figure 20). For example, Yattendon, traditional English bread, offers attractive packaging with a direct labeling system (Calver, 137). The consumers can quickly distinguish the range of product flavors and quantities.

Figure 18. Kashi: Go Lean. Took image from West Hyvee in Ames, Iowa on December 12, 2007.

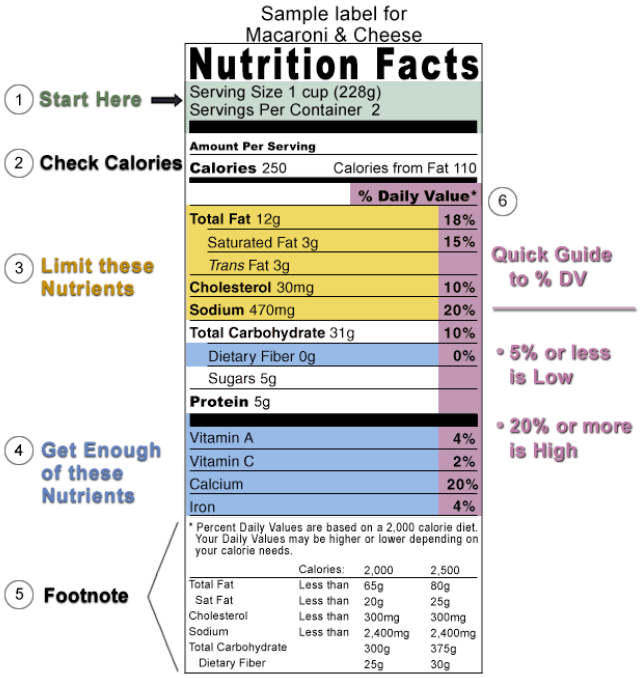

Figure 19. Sample Nutrition Facts Label for Macaroni & Cheese.
Access on April 6, 2008 at www.cfsan.fda.gov.

Figure 20. Yattendon Traditional English Bread (Calver, 137).

The verbal and visual elements; typography, color, shape, imagery, and labeling; play a key role in determining how a packaging design communicates. The visual and textual information on the packaging shapes the consumers' impression, interpretation, understanding, and comprehension of the brand. Careful application of the design principles can produce packaging designs that are effective communication tools. Packaging design can help consumers locate and recognize what they need and want with relative ease.

Discussion About Packaging Issues

Packaging design changes constantly due to the ever-changing target audience and the ongoing need attract and engage their interest. The well-designed package must communicate with the consumer clearly both visually and in terms of content. The consumer must be able to recognize, differentiate, and understand the product in a short

amount of time. Good packaging design is more than simple containment. It helps the consumer make decisions by representing unique attributes, conveying relevant information, and providing a memorable experience with the product. Understanding the different communicative needs and experience base backgrounds, interests, and experiences of the consumers can help guide the use of visual elements, such as typography, color, image, shape, and labeling. Packaging design should respond to the special needs of people with dietary restrictions. All audiences could be better served by recognizing the lack of visual acuity, the fatigue factors (physical, cognitive, and affective), and the specific labeling of nutritional information.

Several examples in the packaging survey are related to shape recognition and functional aspects of the package. However, the complex requirements of ESRD patients force the focus of this study to be restricted to the information presented on a standard food package.

CHAPTER 3: METHODOLOGY AND CASE STUDIES

In order to understand how dietary information and packaging can be more useful and user friendly, this study examined three existing nutritional packaging systems using a case study methodology. The cases examined were *Weight Watchers*, *Kidfresh*, and *NutriSystem: Type II Diabetic Program*. All of the products were selected because they represent packaging designed for unique dietary requirements. The case study methodology permitted an in-depth examination of each package and the needs of its intended audience. From the analysis of the three cases and the evaluation matrix, these items provided the criteria to needed create a nutritional packaging system for ESRD patients on hemodialysis.

Visual Analysis

The visual analysis of the food packaging investigated the visual components of the package, including packaging design principles:

1) Typography communicates with consumers literally and visually
2) Color enhances the visual experience
3) Image engages a connection or association with the product
4) Graphic structure provides instant recognition of the product
5) Labeling provides important attributes of the product.

These components are essential to packaging design and the ability of the consumer to understand, identify, and distinguish the purpose of the product. In addition to the visual

analysis, this study examined the actual textual information provided on the package. This examination took the form of a content analysis.

Visual Analysis 1: Weight Watchers

Weight Watchers has developed a Four Pillars program with two diet plans—Flex (Point) Plan and Core Plan (www.weightwatchers.com, 2008). Its program is committed to provide healthy food, positive experiences, supportive environment, and exercise advice to lose and maintain weight. Weight Watchers' main goal is to assist consumers to be successful in every aspect of life—mentally, emotionally, and physically (www.weightwatchers.com, 2008). Therefore, Weight Watchers created a nutritional packaging system to help consumers choose foods conveniently in a variety of environments. This concept has been a big factor for Weight Watchers in developing a product line and a nutritional packaging system, Smart Ones, which offers flexibility, accessibility, and a simple diet plan. The visual components of the packaging surfaces connect to the consumer and represent the program and plan effectively.

The Weight Watchers food product line offers a variety of different choices: 1) entrées are home-style favorites (Figure 21); 2) any Selections provides grab and go convenience (Figure 22); 3) dessert provides signature products that can be eaten without a guilt (Figure 23); 4) breakfast starts the day with Weight Watchers (Figure 24); 5) the front and back side show the details and informational features of Weight Watchers packaging design (Figure 25).

Figure 21. Weight Watchers: Smart Ones, Entrées.
Accessed on June 5, 2008 at www.eatyourbest.com.

Figure 22. Weight Watchers: Smart Ones, Anytime Selections.
Accessed on June 5, 2008 at www.eatyourbest.com.

Figure 23. Weight Watchers: Smart Ones, Desserts.
Accessed on June 5, 2008 at www.eatyourbest.com.

Figure 24. Weight Watchers: Smart Ones, Breakfast.
Accessed on June 5, 2008 at www.eatyourbest.com.

Figure 25. Weight Watchers: Smart One, Front (Top) and Back (Bottom) of Entrée, Bistro Selection. Took Image from West HyVee in Ames, Iowa on December 12, 2007.

Typography

1. Typographic Personality

   The typography on the Weight Watchers packages defines the brand; the use of the font portrays fun, an upbeat attitude, and the positive aspects of the weight loss program (Figure 25). The positive feeling represented by the packaging gives the user an optimistic attitude toward the product, and toward themselves as a user of the product.

2. Typography Hierarchy

   Weight Watchers uses varying typographic contrasts to guide the consumers through the product information presented on the package. The primary strategies are differences in font and type sizes. The product name, Smart Ones, stands out to allow consumers to identify the product. The brand name, Weight Watchers, is positioned above the product name and is therefore closely associated with it (Figure 25). Product variety names, which differentiate this particular meal from others in the Smart Ones family of products, are next in size hierarchy. Names help consumers to understand the actual contents of the package. The point and nutrient value of the product is the lowest of the hierarchies and comes in the end, in the lower right where the most important usability attributes of the product are shown.

3. Typeface and Type Size

   Weight Watchers employs a variety of typefaces and type sizes. Figure 25 shows italic serif and roman serif typefaces on the product name and variety name using

larger type size to indicate the super category-subcategory relationship of the product to the flavor. Other typefaces, including sans serif and lowercase italic sans serif typefaces, are used for the brand name, the description of the contents, point and nutrient value, and net weight. The sans serif typefaces are also smaller in point size or x-height, which indicate less important information.

4. Legibility and Readability Quality

Weight Watchers utilizes diverse typography to create variety and interest. Their typographic treatments also enable the user to identify and understand the text easily. For instance, the typography in Figure 21 through Figure 25 clearly delivers the message of what the product is. The users are able to recognize and read the name of the brand and product description to access the information.

Color

1. Color Palette

Weight Watchers uses red, white, black, blue, green, and yellow in its package design. Each color represents different components on the package as shown in Figure 25: 1) red color designates overall packaging; 2) white indicates product specifics: the flavor or variety name, the nutrient label, suggestions for use, and product weight; 3) black is used for the ingredients of the food and nutrition facts; 4) blue and green colors explain the point value of the product; and 5) yellow works as an accent, such as the “New” announcement. The dominant colors on the Weight Watchers packaging are red, white, and blue.

2. Communicative Aspects of Color

Weight Watchers' red color gives the product a strong sense of flavor, tenderness, and warmth. As supported by the information from Klimchuk and Krasovec in the literature review. The white color, found on brand name, product name, variety name, provides a feeling of simplicity; the consumer can expect this product to reduce the complexity of dietary monitoring and weight loss. The blue color on the point value system is associated with truth and security which signals users that they can trust the product (Figure 21). Therefore, Weight Watchers color selections on the packages are approachable, accessible, and available for the user. These elements unite the brand name, the product line, the specific variety and product's benefits, to send a positive message about the weight loss program.

3. Product Differentiation and Selection

Weight Watchers uses strong colors on its packaging to differentiate itself from competitors. The red background attracts the eye and allows the product to dominate its point of sale neighborhood. There is very little color differentiation between product lines within the Weight Watchers brand. For instance, the Figure 21 contains many different types of selection such as bistro and classic favorites, however, without close examination it is difficult to determine which package is which type.

Image

Weight Watchers uses large photographs to project an appetizing image for each product variety. The images on the packages are consistently positioned on the right. Each product has a different image. Figure 21 shows an image of food on a clean plate with fork on the left to create a dinner table setting; Figure 22, the Anytime Selection, has an image of a hand holding the food immediately above the napkin and a mini illustrated version of the food to indicate the number of servings per package. The images in Figures 23 and 24 show food on clean plates with a garnish to create appetite appeal. The images on Weight Watchers packages give the brand a strong visual impact and promote positive feelings towards diet food. The images on the packages seem to be attractive, inviting, and pleasing.

Visual Structure and Informational Content

Weight Watchers have developed an interesting labeling system. As shown on Figure 25, the front side of the package identifies the brand, product, and product variety, followed by the product description, product selection, product image, net weight, Weight Watchers point value, and nutritional facts. The back side of the package also has the brand, product name, product image, product variety, product description, cooking instructions, nutrition facts, Weight Watchers points value, website, and recommendations. The packaging repeats the same statement on the front and back side of the package to help consumers remember the product information. The brand name, product name, product variety, product descriptions, and Weight Watcher's value points with nutrient facts are consistently in the same places. The product headline or selections are usually highlighted with a darker color to stand out. However, Weight Watchers uses the banner or oval shape

with different colors for newly added information on the labeling system, which is inconsistent with the color system (Figure 22 and Figure 23). Overall, Weight Watchers labeling system is chaotic. The labels are crowded with too much information on the front; the Weight Watchers point values and nutrient information, which are the most important information for consumers, are subordinated. There is not a strong underlying organizational grid system on the Weight Watchers package.

Visual Analysis 2: Kidfresh

Kidfresh is a grocery store for children that provides freshly made and healthy meals-to-go (Avery, 2007). The Kidfresh system is accessible, handy, and suitable for busy lifestyles (The New York Times, 2007). Its nutritional packaging system is based on serving size and basic nutritional values for four age groups (www.kidfresh.com, 2008). Kidfresh's main focus is to teach children about healthy food, good eating habits, and food choices. The Kidfresh nutritional packaging system targets both children and parents (www.kidfresh.com, 2008). The Kidfresh concept of four age groups is very appealing. Kidfresh offers different color identifiers for each food product line: Grab + Go, Mix + Match, Small portions, and All Natural (Figure 26 and Figure 27).

Figure 26. Kidfresh: Meals-To-Go for Each Age Group.
Accessed on May 27, 2008 at www.landersmiller.com.

Figure 27. Kidfresh: Meals-To-Go for Kids.
Accessed on May 27, 2008 at www.usatoday.com.

Figure 28. Kidfresh Complete Meal Set for Juniors.
Took Image from Kidfresh in New York, New York on June 23, 2008.

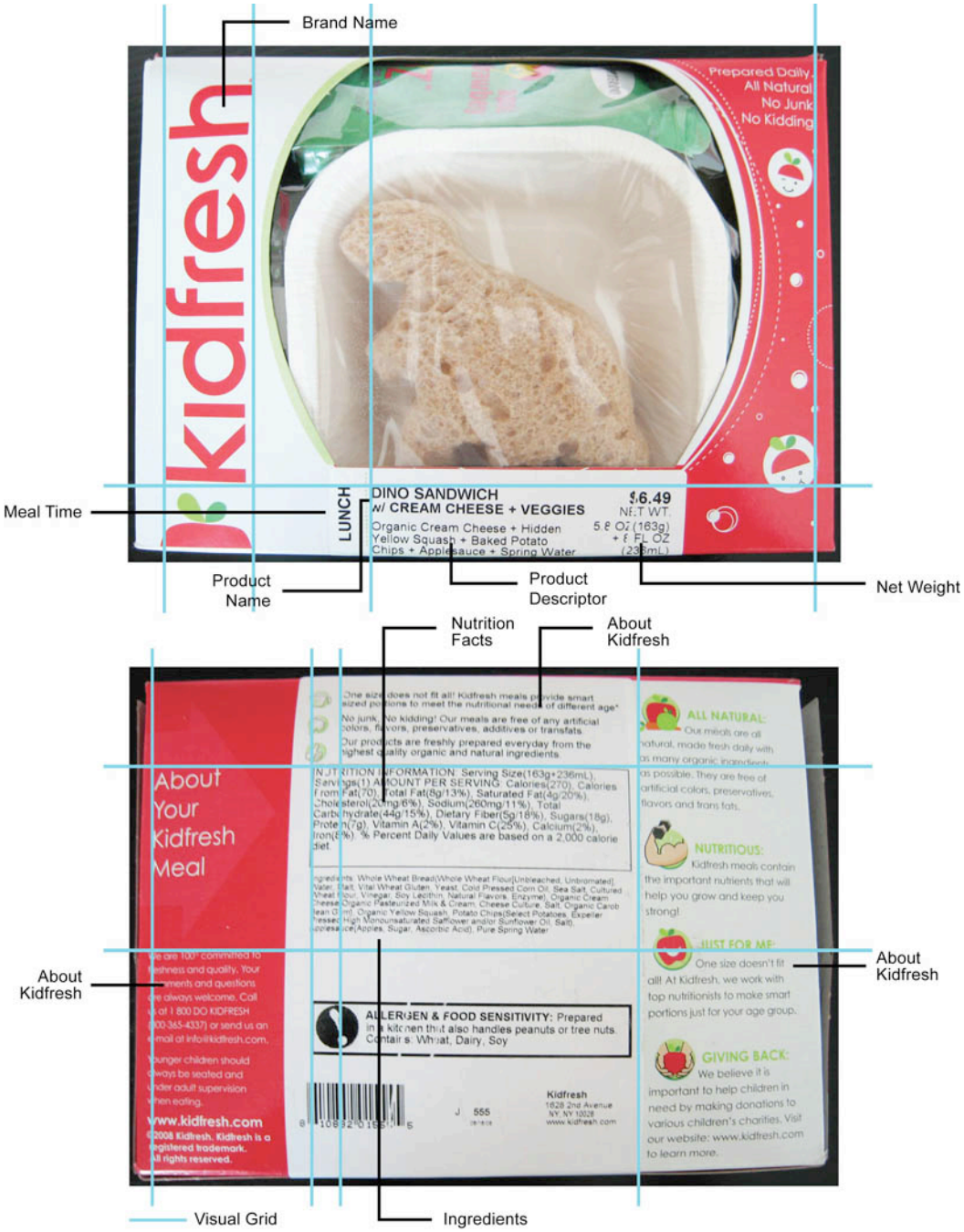

Figure 29. Kidfresh Meals-To-Go Set for Juniors Front (Top) and Back (Bottom). Took Image from Kidfresh in New York, New York on June 23, 2008.

Typography

1. Typographic Personality

The typography on the Kidfresh package has a youthful feel, appropriate to children, its target audience. The package achieves this feeling by using lower case sans serif typography. The typographic identity provides a casual, lighthearted, and joyful introduction to the consumer. Kidfresh also uses product descriptors on the top right corner of the package to emphasize that the product is a freshly made and all natural product (Figure 29).

2. Typographic Hierarchy

Kidfresh uses only one typeface and a typographic hierarchy based on size. The large type size of the brand name is set in a large white area and attracts the eye immediately. The brand name acts as a headline for the package design. The other information on the front of the package includes a description, weight, and ingredients. The type size of these elements is substantially smaller than the headline (Figure 29). This typographic approach brings order and a sense of cohesiveness to the package.

3. Typeface and Type Size

Kidfresh uses only sans serif typeface in different type sizes. The largest type size indicates the most important thing, the brand name, then, other information is set in type of descending size: the product name, recommended age group, and product

descriptors (Figure 29). This approach provides a clean and simplistic hierarchy of information on the package.

4. Legibility and Readability

Kidfresh's typography is very clean, easy, and straightforward. It seems large enough that consumers should find it is easy to read and follow. Also, Kidfresh typography utilizes proper spacing around the text to maximize readability, prevent visual chaos, and avoid confusing the customer (Figure 29). The back of the package, however is somewhat difficult to read due to small print, narrow leading, and crowding (Figure 29).

Color

1. Overall Color Palette

Kidfresh uses six different colors—white, yellow, orange, red, green, and black, on their packaging design (Figure 26). Each color establishes a different age group for the product: yellow represents food for babies, orange is the color for, "minis," red indicates food for "juniors," and green identifies foods for "kids." White is the color of the background; it helps frame the brand name, and black is used for explanatory information about the nutrients and weight of the product. Typography is set in colors that provide adequate contrast with the background.

2. Color Effectiveness

The colors chosen as base colors on the Kidfresh packaging are appropriately symbolic of the age groups they represent. Based on research on color meaning,

yellow color signifies life and playfulness of the baby. Orange color brings cheerfulness, energy, and brightness of the minis; red color characterizes impulsiveness, spontaneous, and excitement of juniors; green color symbolizes the youthfulness of kids (Figure 26). Kidfresh color also shows the progresses of the growth of the children. The colors, yellow to red, get more intense to show the growth and green demonstrate the big kid stage. These simple colors used are friendly, approachable, and pleasant for children.

3. Color Brand Identity

Kidfresh uses easily distinguishable colors to represent a product's character, attributes, and brand identity. Consumers can identify the color of a package or product within the product line by its visual color features.

4. Product Differentiation and Selection

Kidfresh uses color-coding to differentiate products within the line by age group. Each color indicates a different childhood stage (Figure 26). These color approaches seem fun, energetic, and permit consumers to identify products easily. Other than color, the style of the packaging, typography, or location of the visual elements help the product line unified as a system. Kidfresh package color schemes facilitate product selection for each age group (Figure 26). They are immediately identifiable and allow the child to develop a sense of ownership in the product.

Image

Kidfresh uses illustrations instead of using photographs. A simple line drawing style illustration conveys the specific contents and intended age group for the product (Figure 26). They are colorful, cute, funky, and contemporary and should appeal to children, encouraging positive attitudes towards the product.

Visual Structure and Informational Content

Kidfresh offers a customized labeling system based on the nutritional needs of different age groups of growing children. The packaging utilizes a unique color-coding system to help consumers to select the right product (Figure 28). The front side of the package displays the brand name, the age group, the mealtime, the product variety name, and the weight of the contents. The backside of the package displays ingredients and nutritional facts (Figure 29). The information on the nutritional and ingredient labels is cluttered with many types of information that is not simple to read and is difficult to follow.

Visual Analysis 3: NutriSystem

NutriSystem is the ultimate weight loss program for Type II diabetic consumers. Diabetics can eat healthy meals and lose or maintain their weight to stay healthy (Market Wire, 2008). The main aspect of the NutriSystem is the Glycemic Index Plan. It keeps bad carbohydrates out of the diet and ensures steady blood sugar levels along with a satisfied feeling that prevents the user from over eating (www.nutrisystem.com, 2008). Therefore, NutriSystem produces a nutritional packaging system based on meal times. This approach produces a user-friendly, controllable, and convenient nutritional product and package

combination. NutriSystem provides a packaging system that divides itself into meal types: breakfast, lunch, dinner, and dessert (Figure 30).

Figure 30. NutriSystem Advance: Breakfast, Lunch, Dinner, and Desserts. Accessed on June 3, 2008 at www.ebay.com.

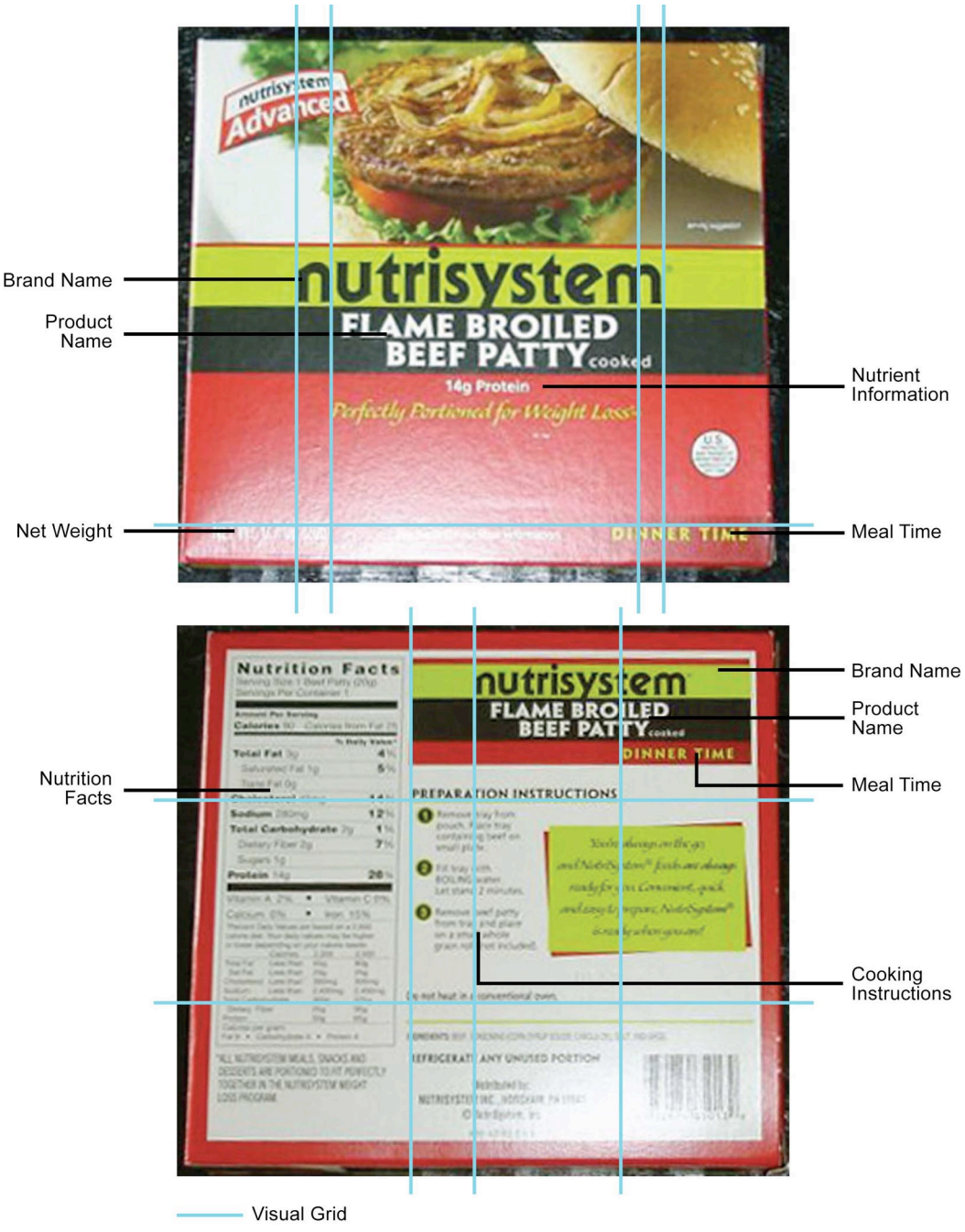

Figure 31. NutriSystem Advance: Front (Top) and Back (Bottom).
Accessed on June 3, 2008 at www.ebay.com.

Typography

1. Typographic Personality

   NutriSystem approaches packaging typography with bold and thick typefaces that to represent security, commitment, and assurance that the weight loss program is effective. The use of a bold, lower case serif typeface for brand name gives a sense the product a feeling of seriousness, and dependability, yet allows it to remain casual and upbeat (Figure 31).

2. Typographic Hierarchy

   NutriSystem utilizes a unique typographic alignment to guide consumers to important information quickly. Brand name, product variety, and nutritional information on protein typography forms a wedge shape that directs the eye downward to the product's catchphrase, "Perfectly Portioned for Weight Loss." The wedge shape also functions to lead the eye step by step over the essential product information (Figure 31). The typography on the NutriSystem package appears to make the text easily readable. The wedge shape of center-aligned text seems to assist the consumers to read the product specifics quickly and in order of importance (Figure 31). The wedge shape of the text creates a hierarchy of information on the NutriSystem package in much the same manner as the headline to a caption system in a newspaper layout.

3. Typeface and Type Size

   NutriSystem uses bold lowercase sans serif type for the brand name, and bold sans

serif in all caps for the product variety, nutritional information, product weight, and mealtime. The size of type is scaled from largest to smallest in direct relation to the importance of the information on the package (Figure 31). The size hierarchy provides an orderly relationship of typographic elements, however, having text in all bold capital letters does not reinforce the hierarchy and lessens readability. The product's catchphrase is the one different element; it uses a serifed italic typeface to distinguish it from the rest of the package's typographic system.

4. Legibility and Readability

NutriSystem contains a variety of weight and scale letterform construction that rely on contrast and simplicity for readability. The use of very bold large scale letterforms for the primary information provides a contrast to the other text driven messages in smaller, less primary information.

Color

1. Overall Color Palettes

NutriSystem uses bright bold colors to create the appeal for consumers with dietary restrictions. Each color has an identifiable function on the package: white is used as for food titles, net weight, nutrition information, and the greater background of the package; black is used for the brand name, nutrition facts, cooking instructions. Red, blue, green, and pink are used to indicate specific meal time choices: red represents dinner, blue color represents breakfast, green color represents lunch, and pink color indicates dessert (Figure 30). These colors are bold and easy to

distinguish from each other. Two colors are used as contrasting backgrounds for type. Yellow color is used as a background band for the brand name, NutriSystem in black, and black is used as the background for the product variety, in white. These are strong contrasting colors that allow the text to be easily read, thus increasing overall legibility. NutriSystem employs all the colors on the package consistently throughout its packaging design system (Figure 31).

2. Color Effectiveness

NutriSystem provides strong color contrast to attract the consumer's attention; for instance, the bright yellow color band behind a darker color brand name (Figure 31). These colors suggest a need to be attentive such as we might find on a caution sign. All the colors on the packages are vivid and colorful. Each mealtime has its own color indicator, and the colors seem to be based on the time of day in which the meal would be eaten. The breakfast package has a blue color associated with early morning, such as the blue sky (Figure 30). For lunch, the quickest meal taken at the busiest time of day, the package is green, the color that implies "go," like a green light (Figure 30). The dinner package uses a red color to signify the most wholesome and flavorful meals of the day, these are the meals that consumers can anticipate and savor after a long day (Figure 30). The dessert package utilizes a pink color to convey a soft, playfulness, and relaxed nature, perhaps what consumer would feel at the end of the day (Figure 30). These colors seemingly portray vibrancy, excitement and drama to attract attention and create an immediate interest in each meal.

3. Color Brand Identity

NutriSystem uses high contrast color schemes to coordinate the brand system (Figure 30). The colors seem arbitrary regarding content of the package but have great unity in the NutriSystem branding mechanism. NutriSystem's uses a series of accent colors on the packaging to allow the products to be easily categorized and organized.

4. Product Differentiation and Selection

NutriSystem uses distinct vibrant colors to distinguish each product type. These differentiations within the product lines help identify the product to the consumer (Figure 30). Once a consumer learns NutriSystem's color-coding system, they can tell at a glance what mealtime offering is contained in each package (Figure 31). The consumer can locate and select the product quickly from the shelf or the refrigerator if they are familiar with the system and the colors.

Image

NutriSystem places a photograph of the each product on the package. The images are consistently located on the top right hand corner of the packaging, occupying a little more than a third of the package front (Figure 31). The images of the products are quite visible so consumers can readily see what they are purchasing. The images of the products do not seem to be very appealing because of the size and poor quality of the photographs. The photos appear to suffer from poor focus, lack of color correction, are poorly printed,

and need better composition. The poor imagery is not as appetizing as it could be and may well lead to a negative first impression of the product.

Visual Structure and Informational Content

NutriSystem provides a customized mealtime labeling system that uses color-coding to make the information clear to the consumer (Figure 30). This informational strategy gives consumers with dietary restrictions an easy way to understand what to eat in a day. The labeling system may be the most innovative packaging feature of the NutriSystem diet. The brand name, product variety name, nutritional facts, product descriptors, product weight, and mealtime assignment are located on the front side. The back side shows the brand name, product variety name, mealtime, nutritional facts, ingredients, and preparation instructions. The packages are functionally simple. The packages lack a detailed description of the contents inside the package.

Design Criteria

The purpose of the case studies was to understand the mechanics of packaging design with regard to food products intended to meet unique dietary needs. Each nutritional packaging system is based on a different set of product values which in turn tend to shape the visual components that appear on the package. To evaluate the relative importance of the visual components on each package, this study created a packaging design criteria matrix with a rating scale. The matrix, (Figure 32) utilizes five groups of criteria to define the qualities relevant to of the packaging design. These criteria are described below.

Typography

Typography deals with how well the typography communicates and connects with the identity, and may be divided into type character, size, weight, and readability.

- Type Character
  The typeface font choices communicate visually to convey a sense of a product's personality. Proper use of typefaces strongly impacts visual communication. The font should be legible and should communicate the intent of the product.

- Typographic Size Contrast
  A well-ordered hierarchy can aid communication, while an improper hierarchy can hinder communication. Text in different sizes may be used with varying levels of contrast to establish an information hierarchy.

- Type Weight -
  Type weight is the thickness or boldness of elements in the letterform. Variations in text weight help to distinguish one kind of information from another or make one text groupings more or less prominent.

- Readability
  Readability assists the viewer to extract meaning from a body of text with reasonable ease.

Color

Color is used to help identify the product and differentiate it from other brands or products, for analytical purposes, it too may be divided into the categories:

- Consistent Use of Color
  The color becomes the brand due to the consistent use.

- Color Contrast
  Variations in Color value are used establish hierarchical information and produce a legible relationship of text to background.

- Color-Coding
  Color-coding is used to differentiate product varieties and flavors within a product line. Color-coding assists the user to navigate the range of product variety options in order to find the right merchandise for their needs.

Image

Imagery can attract consumers' interest and communicate product information, good imagery should be:

- Stopping Power
  The image attracts the users attention quickly and gains immediate reaction.

- Appealing Image
  Attractive and appetizing appeal that invites consumption.

- Differentiation
  Assist the user to distinguish one food type from another.

- Emotive Value
  An image can have a positive or negative effect on a user's experience and attitude toward the product depending on whether that image is interesting and appealing or deceptive and dull.

Visual Structure

Visual structure deals with organization of information on the package including grids, hierarchy, and contrast.

- Organization of information is logical.
- Relative importance of the information is apparent, proceeding from most to least important.
- Underlying structure provides orderly placement of elements.

Graphic Layout Of Package Surfaces

Graphic elements provide the informational content consumers need, combined with sufficient legibility and organization to make it clear. For purposes of analysis, graphic elements were divided into the following categories:

- Identity
  The combinations of elements, such as the brand name and sub brand name that can be either individually or collectively reflect the identity of the product.
- Product Descriptors
  The label helps the user to identify the name and description of the food.
- Product Component
  The package states the net weight of the contents, so the user knows the amount of food in the containers.
  The package provides a list of the ingredient contents.

- Information Layout and Hierarchy
  Package label information presented in such a way that the reader progresses through it in an orderly fashion, from most important to least important.
  The label provides information that can help the user to distinguish and select the product.
  The label provides clear information to evaluate and compare the product.

- Nutrient labeling System and Unique Benefits
  Package states the nutritional values of the product, such as calories, protein, and sodium.
  Package states the specific amounts of nutrient values quantities
  Package states the specific serving size of the contents.
  Label addresses to the user's specific needs.
  The label is clear and simple enough that the user can follow the system easily.
  The label provides descriptions of individual nutritional benefits to help consumers to understand the value of the product.
  The label provides the specific amounts for the dietary or nutritional information.
  The label provides information to help the user regulate their intake of specific nutritional elements, understand, and measure the portion they are consuming.
  This label is federally mandated by Unites States Food and Drug Administration and must be found on every food package sold in the United States (FDA, 2008).

In order to understand how each brand focuses on the most important aspects of the packaging design; the criteria established by the research were rated by category. The rating was accomplished using a Likert-type number scale, from one to four, where one was,

"excellent," and four was, "poor." The Likert rating provided a thorough and quantifiable way to analyze and compare the labeling features (Table 2). The possible ratings on the ranking scale were: Excellent, the rating of number 4 was assigned when the information presented by the packaging was include every desired information with design principles; Good, the rating of number 3 was assigned when the package design included most of the desired information, but did not necessary used found design principles; Fair, the rating of number 2 was assigned when the information presented by the packaging was in someway inadequate; Poor, the ratings of number 1 was assigned when the packaging design was not acceptable. These packaging evaluations measured the utility of essential visual components in packaging design relative to the needs of ESRD patients. The purpose was to identify how other nutritional systems worked with package information.

	Excellent (4)	Good (3)	Fair 2)	Poor (1)
Typography	All typography communicates a concept clearly, comprehensively, and consistently.	Most of the typography communicates a concept clearly, comprehensively, and consistently.	Some of the typography is communicating a concept clearly, comprehensively, and consistently.	The typography is not effective in the communication of the concept.
Color	All the colors work to identify the brand clearly and use color schemes consistently to differentiate product varieties within a product line.	Most colors work to identify the brand clearly and color schemes are used consistently to differentiate product varieties within a product line.	The more than half of colors inadequately identify the brand and color schemes do not use consistently work to differentiate product varieties within a product line.	The colors are not effective in identifying the brand and do not differentiate product varieties within a product line.
Image	All images present a specific subject that clearly convey a message, are attractive, and well organized.	Most of images present a subject adequately to convey a message or diet; organization is adequate.	The majority of image is not attractive and do not communicate adequate information; organization is inadequate.	The image does not communicate effectively and organization is random.
Visual Structure	All information is well organized, logical, and relates to concept.	Most of information is organized, consistent, and relates to concept.	The more than half of information is inadequate and inconsistent with concept.	The information is not useful, not clear, and difficult to understand.
Information Content	All content contains and communicates specific detailed information clearly, is well organized and easily understood.	Most of content contains and communicates some information, is organized, and understandable.	The more than half of content is inadequate or do not address specific but necessary information, is inconsistent, and difficult to understand.	The content is not significant and do not relate needed information.

Table 2. Likert-type Number Scale for Each Category.

	4 = Excellent 3 = Good 2 = Fair 1 = Poor	Weight Watchers				Kidfresh				NutriSystem: Type II Diabetic			
	Rating Scales	4	3	2	1	4	3	2	1	4	3	2	1
	Attributes												
Typography	Type Character	X				X					X		
	Type Size Contrast		X					X			X		
	Type Weight Contrast			X				X				X	
	Readability		X				X			X			
	Total (Out of 16)	12				11				12			
Color	Consistent Use of Color	X				X				X			
	Color Contrast			X			X				X		
	Color-Coding				X		X			X			
	Total (Out of 12)	7				10				11			
Image	Stopping Power	X						X				X	
	Appealing Image	X							X			X	
	Differentiation		X				X				X		
	Emotive Value	X							X			X	
	Total (Out of 16)	15				7				9			
Visual Structure	Organization		X				X			X			
	Relative importance			X				X				X	
	Hierarchy	X					X			X			
	Total (Out of 12)	9				9				10			
Graphic Layout of Package Surfaces	Identity	X				X					X		
	Product Descriptors		X					X				X	
	Product Component			X				X					X
	Information Layout & Hierarchy		X				X			X			
	Nutrient Labeling System & Unique benefits		X						X			X	
	Total (Out of 20)	15				12				12			
	Overall Total (Out of 76)	58				49				54			

Figure 32. Packaging Design Criteria Matrix.

Based on the use of this evaluation matrix and the criteria established for communication of the packaging information, Weight Watchers scored the highest and Kidfresh scored the lowest, overall (Table 3). Weight Watchers packaging design is dominated by brand identity, image, and product information, which communicates their brand very effectively. Weight Watchers places more emphasis on the information on the surfaces of the package than either Kidfresh or NutriSystem's packaging. Kidfresh and NutriSystem were strongest in color-coding and labeling systems in terms of clarity. NutriSystem's packaging is particularly interesting because it appears to strike a balance between the strengths of the Kidfresh packaging and the weaknesses of Weight Watchers package. All of the packages lack specific information on nutritional facts needed for users with dietary restrictions to be sure what they are consuming.

	Weight Watchers	Kidfresh	NutriSystem: Type II Diabetic
Typography (Out of 16)	12	11	12
Color (Out of 12)	7	10	11
Image (Out of 16)	15	7	9
Visual Structure (Out of 12)	9	9	10
Graphic Layout Of Packaging Surface (Out of 20)	15	12	12
Total (Out of 76)	58	49	54

Table 3. Results from the Packaging Design Criteria Matrix.

The rating scores in each case study were assigned by the researcher as an evaluator with expertise in graphic design. In this sense they were subjective and likely to vary according to whomever is using this system. They are, however, consistent from one product to another, because the same evaluator scored all three package designs. In order to have higher validity of the evaluation matrix a more comprehensive study using independent evaluators would be needed. The matrix was designed to evaluate graphic information on the packaging surfaces.

Findings

In order to understand how to approach and develop a nutritional packaging system for ESRD patients on hemodialysis, three of the existing nutritional packaging systems were examined and compared for graphic information on the packages surfaces. These systems were selected to represent different nutritional needs: weight loss, children's dietary needs, and a diabetic diet. The analysis revealed that each system had distinctive and potentially useful features.

The analysis process discovered and identified the following considerations that would be fundamental to the development of the intended ESRD friendly packaging design:

- Typography that defines a unique personality to communicate with consumers visually. Uses a variety of typefaces, type sizes, contrasts, and repetition of information to distinguish the product and make it memorable. Avoid too many typographic groupings that clutter the package design.

- Utilizes a key color to stand out from competitors. The red color theme in Weight Watchers definitely catches consumers' attention and makes an

association with the brand instantly. Red color overwhelms the other colors, such as the blue color for the points value system that should allow consumers to count their points quickly. Additionally a color-coding system for various products is useful.

- Create a very appealing image for each product. Images should be playful, appetizing, and inviting. Position images in the same place consistently and with each product having a different image to portray product selections. Make sure each image is powerful and provocative.

- Provide a user-friendly, informative, easily read labeling system that goes beyond federally mandated information.

- Typography should be simple, easy to read, and straightforward because of cognitive fatigue.

- Provides a variety of colors to distinguish each product variety by type. Colors that are bright, vibrant, and energetic create positive and friendly attitudes toward the package and its contents. Color-coding facilitates selection of the correct product at a glance.

- Kidfresh substitutes a viewing window for an illustration or a photograph as representation of the contents. Real food is visible through the package window. Other illustrations give the product a fun feeling with a smiley face sandwich on the side to portray the brand character.

- Create a unique labeling system based on dietary needs.

Visual Effectiveness for application to an ESRD Nutritional Packaging System

Each product studied has provided crucial components to the conceptual model of a nutritional packaging design for ESRD patients on hemodialysis. Product analysis and visual analysis revealed each product's strengths and weaknesses.

However, one consistent problem was apparent in the packaging of all the companies studied. Although these products and designs focus on healthy and nutritional food, they lack adequate nutrient information on the package. Consumers depend upon the brand package, instead of learning what nutrients they are actually consuming. Most of the packages provide some basic nutritional facts on the front but this information is more for marketing and does not provide information related to dietary restrictions. All of the food packaging studied appears to provide the necessary federal nutritional information, however, for consumers who have severe dietary restrictions this information is in adequate and difficult to understand. Consumers who have ESRD need to know the correct amount of eight elements: calories, protein, sodium, phosphorous, calcium, potassium, vitamins and minerals, as defined in the literature review. This is one of the major issues that this study will attempt to correct in designing prototype food packaging for ESRD patients. ESRD patients typically suffer from fatigue (cognitive, physical, and affective), and the design of the prototype package will be conceived with these factors in mind. Solving this design problem will constitute a successful and useful product design intended for ESRD patients.

CHAPTER 4: A NUTRITONAL PACKAGING DESIGN PROTOTYPE

From the analysis of three existing nutritional packaging systems and the design criteria matrix explained in Chapter 3, a set of objectives was established for the design of a nutritional package system appropriate to the needs of ESRD patients on hemodialysis. These objectives will be used as the basis for a new prototype design and are described below.

- Create an appetizing and readable packaging system that emphasizes fresh appealing foods and does not resemble medical packaging. This addresses the effective fatigue associated with ESRD patients.

- Develop package design that clearly communicates product information. This will provide for a clear choice of food groups and will develop an identity system.

- Develop a consistent and accurate nutritional label design system with strong product differentiation that visually represents the nutritional facts printed in detail on the back of the package. This will address the cognitive fatigue and provide necessary specific nutritional information.

- Use design principles and research to create a package that communicates effectively and is visually pleasing. This address the emotional and social needs of eating and the desire of all people to feel “normal.”

Before proceeding it would also be wise to arrive at some basic understanding of what should be expected of a design system. According to Rob Carter, Ben Day, and Philip Meggs, professors at Virginia Commonwealth University, a design system is a group of

items that are part of a greater whole (Carter, Day, and Meggs, 292). In systems design, therefore, the designer must incorporate something that unifies the system, and something that differentiates the parts. A well-designed system, therefore has something that is the same on all the products in the system, and some way in which each product or product family is unique among its counterparts. Using these research-based objectives, a package design prototype for ESRD patients was created.

Figure 33. Prototype Design: Simply Eight, Entrée. (Image at 3:4 Scale, Original Size 8 in x 6 in). Image is from http://pro.corbis.com/ Accessed on June 23, 2008.

Figure 34. Prototype Design: Simply Eight, Back Side of Entrée (Image at 3:4 Scale, Original Size 8 in x 6 in). Image from http://pro.corbis.com/ Accessed on June 23, 2008.

Figure 35. Prototype Design: Simply Eight, Side Dish (Image at 3:4 Scale, Original Size 8 in x 6 in). Image from http://pro.corbis.com/ Accessed on June 23, 2008.

Figure 36. Prototype Design: Simply Eight, Dessert (Image at 3:4 Scale, Original Size 8 in x 6 in). Image from http://pro.corbis.com/ Accessed on June 23, 2008.

Evaluation of the Prototype Design: Simply Eight

The prototype problem was to find a simple way to package healthy, convenient, and manageable meals-to-purchase for ESRD patients. The second part of the problem was to provide clear nutrient information that they can access without difficulty, given the visual and fatigue factors associated with this disease. Therefore, the prototypes are formulated to communicate the essential nutrient information discussed in the literature review, the information which is critical for ESRD patients on hemodialysis.

The prototype design was designed using the criteria established in the evaluation matrix and would therefore score higher if it was evaluated.

The Prototype

The name of the prototype design, "Simply Eight," was inspired by the eight nutrient elements that affect the diet of ESRD patients. The nutrient markings are prominent, easy to pronounce and easy to read. ESRD patients need to measure their nutrient intake carefully in order to maintain their health, therefore the prototype provides a simple way for ESRD patients to access the nutrient information immediately (Figure 33 and Figure 34).

The need to address complex dietary requirements meant that the typographic design must present an unusual quantity of nutritional information. Therefore, the prototype used a hierarchy based on different typographic styles, color, and graphics to organize the information. Sans serif and serif typefaces with different type sizes are used on the prototype to produce an easy to read format that differentiates the various features, and gives the product visual appeal (Figure 33 and Figure 34).

Color was strategically applied to each prototype design within the system to distinguish the product and identify it as part of the system. First, each prototype design (Figure 33, 35, and 36) has its own color to help ESRD patients to define the product visually. The color orange is used to indicate entrées and the warm orange color brings to mind the warmth and comfort of food (Figure 33 and Figure 34). Green presents a side dish and is reminiscent of healthy green vegetables; it communicates a simple pleasing meal (Figure 35). The color yellow identifies desserts that create excitement and anticipation for the sweetness of the treat (Figure 36). A white background is used on the prototype provide a clean feeling and to maximize legibility and readability by providing good visual contrast for the body text. Finally, the eight key nutrients are represented as color-coded circles containing actual quantities. Adding colors to express nutrient information and setting this information apart in a row of circles makes it immediately accessible to the reader (Figure 33). The development of the color-coded nutrient information on the label helps ESRD patients to understand the information visually and make the connection between nutrition facts information immediately (Figure 34).

The prototype proposes to develop an engaging way to help ESRD patients find the foods they need. The consistent use of nutrient information on the front side of the prototype helps the patients to make clear and timely decision. The information was designed to have strong visual appeal and is specially adapted to meet the needs of ESRD patients (Figure 33). Information on the front of the package relates to information on the back by repetition the nutrient information circle on the nutritional fact to access the information quick and easy. This system attempts to make it easier for ESRD patients to distinguish the nutritional facts on the backside of the package (Figure 34).

Appealing images appear consistently in the lower right corner to preview the appetizing meal, attempting to provoke the appetite in patients on restricted diet. The images are repeated on the front (Figure 33) and back (Figure 34) to maintain the visual image and make the product identity apparent a while they are reading the information on either the front or back of the package. If the patients want more information, they can read both front and back to get all the info.

Summary

Using the design objectives as an organizational skeleton to assist meeting the needs of ESRD patients. The prototype design utilized a fresh appetizing image that relate to ESRD patients. ESRD patients need to measure their food, therefore providing a proportional image helps them to relate and makes the food seem more approachable. Providing nutritional information on the front and back of the prototype addressed the special nutritional needs of this population. Using clear typographic hierarchies, graphic devices and composition to direct the eyes, fonts chosen for legibility for vision impairment, product information that is consistent, and a package that is approachable was a direct result of the use of the research and matrix. The crucial measurements for nutrition are provided with the different color-coding provides a visual cue for ESRD patients to access the nutrient information easily. These colors have been tested for color fidelity in Vischeck (www.vischeck.com), a program that simulates color blindness.

CHAPTER 5: CONCLUSION

The purpose of this study was to design a packaging system that focuses on the nutritional needs of ESRD patients. This process began with an investigation into the dietary needs of ESRD patients and the principles of packaging design. This investigation revealed that ESRD patients need to regulate a number of nutritional elements in order to maintain their health. This studied also conducted a series of case studies on current nutritional packaging systems for specific groups such as weight loss, meals-to-go for children, and Type II diabetes. The knowledge gained from this research and these case studies was used to define a set of objectives for a new packaging prototype for ESRD patients. These objectives focused on the following aspects: appropriate typography, a color system, and a labeling system that offers easily accessible nutritional information that is necessary to the ESRD patient. Following these objectives, a prototype packaging system for ESRD patients was created.

Future Recommendation

The research about ESRD patients on hemodialysis and case studies of existing nutritional packaging system has provided extensive information that was used to develop a prototype. This prototype has yet to be tested by actual ESRD patients in a real world situation. Testing the prototype is a necessary data gathering process that could expose certain limitations of the packaging system. The data and suggestions gained from ESRD patients would lead to an improved design and would create a more useful packaging

design that better meets their nutrition needs. This testing could be accomplished by working closely with a hospital or clinic that deals with ESRD patients.

Before reaching the consumer market, the packaging system prototype would need to be applied to a complete product line. A complete line would have multiple products in multiple shapes and sizes. Creating multiple packaging designs for multiple products can provide ESRD patients and others with dietary restrictions a variety of food choices. The patients can mix and match to be flexible and accessible. This product line would also require the development of a complete nutritional program unique to ESRD patients or others with dietary restrictions that could be used as the basis for a packaging design. This would require extensive research into patients' nutritional information as well as how to create a nutritional meal plan. This would require much more specific information and would require working with a renal diet nutritionist in order to determine what works best for ESRD patients.

This packaging system is intended help ESRD patients cope with the added difficulty of having to live with and maintain a strict nutritional diet. Though packaging could greatly reduce the difficulty of this task, a complete support program would be a great benefit. By applying eight nutrients on the package assist to reduce the obstacles, the packaging system can reduce the time and energy needed to select and prepare meals to access the food little time spent cooking; the attractive package design portrays appetizing meals to encourage food consumption; and the patients do not need to search for vital nutrient information on the back of the package. This program would include educating ESRD patients about their nutritional requirements, teaching them healthy eating habits,

and forming support groups comprised of fellow ESRD patients that could provide motivation and encouragement to maintain healthy eating habits.

The process described above does not need to be confined to the area of ESRD patients; it could also be used to create packaging systems for other conditions that have unique nutritional requirements. With additional research these strategies or understandings could be applied to cancer, heart disease, and hypertension. Also, a simple hand held device such as cell phone, palm pilot, or mp3, could compute the nutrient information digitally in the future. These items can scan the bar code to help ESRD patients or others, who have specific dietary conditions, to access the information right away.

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